



NAVAL POSTGRADUATE SCHOOL

MONTEREY, CALIFORNIA

THESIS

**FLOOD MITIGATION AND RESPONSE: COMPARING
THE GREAT MIDWEST FLOODS OF 1993 AND 2008**

by

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December 2010

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REPORT DOCUMENTATION PAGE			<i>Form Approved OMB No. 0704-0188</i>	
Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instruction, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704-0188) Washington DC 20503.				
1. AGENCY USE ONLY (Leave blank)		2. REPORT DATE December 2010	3. REPORT TYPE AND DATES COVERED Master's Thesis	
4. TITLE AND SUBTITLE Flood Mitigation and Response: Comparing the Great Midwest Floods of 1993 and 2008			5. FUNDING NUMBERS	
6. AUTHOR Lieutenant Colonel Tracy L. West				
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Naval Postgraduate School Monterey, CA 93943-5000			8. PERFORMING ORGANIZATION REPORT NUMBER	
9. SPONSORING /MONITORING AGENCY NAME(S) AND ADDRESS(ES) N/A			10. SPONSORING/MONITORING AGENCY REPORT NUMBER	
11. SUPPLEMENTARY NOTES The views expressed in this thesis are those of the author and do not reflect the official policy or position of the Department of Defense or the U.S. Government. IRB Protocol Number: N/A.				
12a. DISTRIBUTION / AVAILABILITY STATEMENT Approved for public release; distribution is unlimited			12b. DISTRIBUTION CODE A	
13. ABSTRACT (maximum 200 words) Floods are the nation's greatest natural disaster. According to the U.S. Geological Survey, floods cause an average of \$6 billion of property damage, claim 140 lives, and prompt more Presidential disaster declarations per year than any other hazard. The Federal Emergency Management Agency (FEMA) is the lead for federal response to natural disasters. FEMA was the lead agency in 1993 when floods caused an estimated \$18 billion in damage in the Midwest. The scope and damages of this historic disaster led FEMA to change its approach to floodplain management, flood protection, flood mitigation, disaster response, and recovery. FEMA and federal emergency response further evolved following the terrorist attacks on September 11, 2001 and Hurricane Katrina in 2005. The latest changes resulted in a national response framework for all levels of government to prepare and respond to all natural and manmade hazards. In 2008, the Midwest experienced its second "500-year flood" in fifteen years. This thesis examines whether changes to national disaster response and investments in flood mitigation over the last fifteen years have improved preparation, protection, and response capabilities at the federal, state, and local levels.				
14. SUBJECT TERMS: Disaster Response, Disaster Recovery, Emergency Response, FEMA, Flood Mitigation, Flood Protection, Hazard Mitigation Grant Program, National Response Framework			15. NUMBER OF PAGES 117	
			16. PRICE CODE	
17. SECURITY CLASSIFICATION OF REPORT Unclassified	18. SECURITY CLASSIFICATION OF THIS PAGE Unclassified	19. SECURITY CLASSIFICATION OF ABSTRACT Unclassified	20. LIMITATION OF ABSTRACT UU	

NSN 7540-01-280-5500

Standard Form 298 (Rev. 2-89)
Prescribed by ANSI Std. Z39-18

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MIDWEST FLOODS OF 1993 AND 2008**

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Submitted in partial fulfillment of the
requirements for the degree of

**MASTER OF ARTS IN SECURITY STUDIES
(HOMELAND SECURITY AND DEFENSE)**

from the

**NAVAL POSTGRADUATE SCHOOL
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ABSTRACT

Floods are the nation's greatest natural disaster. According to the U.S. Geological Survey, floods cause an average of \$6 billion of property damage, claim 140 lives, and prompt more Presidential disaster declarations per year than any other hazard. The Federal Emergency Management Agency (FEMA) is the lead for federal response to natural disasters. FEMA was the lead agency in 1993 when floods caused an estimated \$18 billion in damage in the Midwest. The scope and damages of this historic disaster led FEMA to change its approach to floodplain management, flood protection, flood mitigation, disaster response, and recovery. FEMA and federal emergency response further evolved following the terrorist attacks on September 11, 2001, and Hurricane Katrina in 2005. The latest changes resulted in a national response framework for all levels of government to prepare and respond to all natural and manmade hazards. In 2008, the Midwest experienced its second "500-year flood" in fifteen years. This thesis examines whether changes to national disaster response and investments in flood mitigation over the last fifteen years have improved preparation, protection, and response capabilities at the federal, state, and local levels.

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LIST OF ACRONYMS AND ABBREVIATIONS

9/11 – September 11, 2001

ASFPM – Association of State Flood Plain Managers

CFU – Cedar Falls Utilities

CRP – Conservation Reserve Program

CRS – Congressional Research Service

DHS – Department of Homeland Defense

EOC – Emergency Operations Center

ESF – Emergency Support Functions

FEMA – Federal Emergency Management Agency

FCIP – Federal Crop Insurance Program

FIRESCOPE – Firefighting Resources of California Organized for Potential Emergencies

FMA – Flood Mitigation Assistance

FRP – Federal Response Plan

GAO – Government Accountability Office

GSA – General Services Agency

HMGP – Hazard Mitigation Grant Program

HSPD – Homeland Security Presidential Directive

HUD – [Department of] Housing and Urban Development

ICS – Incident Command Structure

IFMRC – Interagency Floodplain Management Review Committee

NAPA – National Academy of Public Administration

NFIP – National Flood Insurance Program

NGA – National Governors’ Association

NHSA – National Homeland Security Agency

NIMS – National Incident Management System

NOAA – National Oceanic and Atmospheric Administration

NRF – National Response Framework

NRP – National Response Program

NWS – National Weather Service

RFC – Repetitive Flood Claims

SFHA – Special Flood Hazard Area

SRC – Severe Repetitive Loss (SRL)

U.S. – United States

USACE – U.S. Army Corps of Engineers

USGS – U.S. Geological Service

ACKNOWLEDGMENTS

For starters, I want to acknowledge the entire Naval Postgraduate School staff for their professionalism, academic drive, and understanding of the unique service they to active duty military personnel. The entire team of thesis processors also deserves recognition for their great advice and the amount of time they spent to help get this thesis in its final form.

Both of my advisors, Professor Craig Hooper and Professor Daniel Moran, deserve grateful recognition for their guidance, support, and patience throughout this effort. I would like to thank Professor Hooper in particular for his encouragement and invaluable insight.

During my research I also received crucial inputs from floodplain management and emergency response professionals who were directly involved in pre-2008 flood mitigation efforts and the 2008 Midwest Floods emergency response and recovery. The contributions from the Waterloo and Cedar Falls city staffs, the Black Hawk County Emergency Management Office, the U.S. Army Corps of Engineers Rock Island District Office, and the U.S. Geological Service Illinois Water Science Center provided source data and insight critical to this study. I am extremely grateful to everyone who took the time to help me even while they were still recovering from the 2008 floods.

Finally, I want to thank the two most important people in my life: my wife, Ashley, and my daughter, Gloria. Both of them provided much needed motivation throughout, and Ashley earns my deepest appreciation for her persistent patience and all the sacrifices she makes for me to succeed.

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I. INTRODUCTION

A. MAJOR RESEARCH QUESTION

Record floods devastated the Midwest in 1993. The lead federal agency for disaster response was the Federal Emergency Management Agency (FEMA). The scope of the devastation from this historic event changed the way FEMA handled natural disasters and provided a new approach to floodplain risk management, flood mitigation, and flood response efforts. FEMA's bureaucratic re-orientation after the terrorist attacks on September 11, 2001, and tested by Hurricane Katrina in 2005 led to further modifications resulting in an all-hazards approach to emergency federal response. In 2008, the Midwest experienced its second "500-year flood" in fifteen years.¹ Comparison of the short-term impact of the floods and the response to the floods offers data that can answer the following two questions: Have the changes to national disaster response and the investments in flood mitigation since the Great Flood of 1993 worked? In light of recent record flooding in the Midwest, did prior mitigation efforts reduce damage to personnel and property and have the most recent changes positively impacted emergency response?

B. SIGNIFICANCE

Floods cause an average of \$6 billion in property damage and kill approximately 140 people in the U.S. every year.² Major floods not only cause direct damage to the areas affected, they also have a cascading effect due to the disruption of transportation systems, food and water supplies, and other economic damages to local businesses and agriculture. For example, the total damages from the 1993 floods are estimated at

¹ The term "500-year flood" can be misleading. It implies a 1-in-500 (or a .2 percent) chance a flood will occur in a given year. A more frequently used example is the "100-year flood," which implies a 1-in-100 (or 1 percent) chance a flood of that magnitude will occur in a given year. Robert Holmes and Heidi Koontz, "Two 500-Year Floods Within 15 Years—What are the Odds?," http://64.233.167.104/custom?q=cache:rJbJ1LjaI0gJ:www.usgs.gov/newsroom/docs/flooding_in_20080620.pdf+two+500-year+floods&hl=en&ct=clnk&cd=3&gl=us&client=google-coop-np (accessed 8/18/2008).

² *Flood Hazards—A National Threat*, USGS Fact Sheet 2006–3026 (U.S. Geological Survey: 2006).

\$18 billion.³ Iowa accounted for more than \$3.4 billion of the 1993 total. Property damages exceeded \$1 billion of the \$3.4 billion of damage in the state, and agriculture damages accounted for an estimated \$1.9 billion.⁴ In 2008, floods destroyed twenty percent of Iowa's total grain crop and economic losses alone are preliminarily estimated to exceed \$2 billion.⁵

Realizing floods are a natural phenomenon that cannot completely be avoided, flood mitigation and response is an important national endeavor that strives to minimize the overall impact of floods and decreasing national costs associated with response and recovery. This study enumerates mitigation and response-preparation efforts over the last fifteen years to identify both successful and unsuccessful measures to demonstrate where the federal government should focus its efforts and funds to minimize the impact of future floods and improve future response actions.

In addition to providing policy guidance in the area of flood mitigation by comparing these two events, the research provides a first look into a major disaster response using the implementation of national guidance since Hurricane Katrina. The results could serve as a data point for FEMA and the Department of Homeland Security (DHS) to demonstrate effectiveness of recent changes, that DHS is leaving the specter of Hurricane Katrina behind, and serve future analysis to ensure continuous improvement.

³ Estimates range between \$5 and \$25 billion. The Galloway Commission ranged the damage between \$12 and \$16 billion; however, the report admits that its numbers were premature and not all encompassing. For consistency purposes, this thesis uses the \$18 billion estimate from William G. Hoyt and Walter B. Langbein's detailed review of the 1993. Stanley A. Changnon, in *The Great Flood of 1993: Causes, Impacts, and Responses*, ed. Stanley A. Changnon (Westview Press: Boulder, CO, 1996), 3.

⁴ Changnon, 8, and 210–11; Gary P. Johnson, Robert R. Holmes, Jr., and Loyd A. Waite, "The Great Flood of 1993 on the Upper Mississippi River—10 Years Later," USGS Fact Sheet 2004–3024 (U.S. Geological Survey: May 2004), 2.

⁵ Rick Mattoon, "Midwest Economy: Assessing the Midwest Floods of 2008 (and 1993)," http://midwest.chicagofedblogs.org/archives/2008/07/mattoon_flood_b.html (accessed 8/3/2008); "U.S. Midwest Floods Choke Rail, Barge, Road Traffic - Cattle Network," <http://www.cattlenetwork.com/Content.asp?ContentID=229291> (accessed 8/19/2008); Dennis Coday and Rich Heffern, "Midwest Floods," *National Catholic Reporter* 44, no. 23 (7/11/2008): 5–7; Michael Judge, "After the Flood," *Wall Street Journal* (June 17, 2008): A.21; "Iowa – Midwest Flood News & Statistics | MCEER Information Service," <http://mceer.buffalo.edu/infoservice/disasters/iowa-flood-news-statistics.asp> (accessed 8/3/2008).

C. PROBLEMS AND HYPOTHESES

Have the changes to national disaster response and the investments in flood mitigation since the Great Flood of 1993 worked? In light of recent record flooding in the Midwest, did prior mitigation efforts reduce damage to personnel and property and have the most recent changes positively impacted emergency response? These questions directly address the problems of whether the U.S. federal government improved based on lessons learned from previous natural disasters and whether investments in flood mitigation and changes to response capabilities have been worth the costs over the last fifteen years.⁶

My hypothesis is the \$54 million spent by FEMA, state, and local governments on mitigation efforts in Iowa since the 1993 floods, combined with tighter integration of the federal response system with state and local response organizations, have improved the overall situation.⁷ However, shortcomings are also expected. For example, planning errors are expected where flood mitigation changes and investments were ineffective or did not have the desired effect. Details from both the successful endeavors and the shortcomings will lead to recommendations designed to enhance and focus federal efforts to minimize the impact of future floods.

D. LITERATURE REVIEW

Floods are natural phenomena that occur when streams, rivers, and lakes overflow their banks. In the context of natural disasters, floods are defined by the amount of damage they cause to people or property. If people did not inhabit flood-prone areas, the natural phenomena of a river exceeding its notional capacity and overflowing into the surrounding areas, often referred to as floodplains, would preclude floods from being labeled a natural disaster. However, flood-prone areas are attractive for human

⁶ The 1993 floods cost the federal government \$4.2 billion for response and recovery. A large portion of FEMA's \$1.14 billion was spent on hazard mitigation of over 12,000 properties. Johnson, et al. (2004), 4.

⁷ "Buyouts Dramatically Demonstrate Avoided Flood Damage: Two Cities, One Tale," http://www.wvdhsem.gov/WV_Disaster_Library/Library/FLOODS/FEMA-Buyout Mitigation.htm (accessed 8/19/2008).

settlements for a variety of reasons. Some of the reasons are transportation, readily available water supplies, power production, rich soils for agriculture, and for the simple beauty of the surrounding areas. In short, people populate the flood-prone areas for human convenience.⁸

Because of the value and convenience, the U.S. has a large number of developments in flood-prone areas. Fifteen percent of the nation's urban areas are subject to flooding, and approximately \$900 billion in property and 10 million households are subject to the risk of floods. Floods cause an average of \$6 billion of property damage and claim 140 lives each year. According to the U.S. Geological Survey (USGS), floods are the nation's greatest natural disaster, and floods prompt more Presidential disaster declarations per year than any other hazard.⁹

Due to the scope of the threat and the enormous amount of damage caused by floods each year, there are several different strategies to manage floodplain mitigation and emergency response to floods. The following paragraphs detail the components of the core debates within these two areas.¹⁰

The first debate affects both flood mitigation and emergency response to floods. This debate focuses on the role of federal, state and local governments. The debate over the federal government's responsibilities with respect to flood control began in the 1800s as the impact of floods began to gain national attention. A Supreme Court case in 1824, *Gibbons v. Ogden*, initially opened the door for federal involvement in flood control by citing Article I, Section 8 of the Constitution. Section 8, known as the "Commerce Clause," gives Congress authority to regulate interstate commerce. In this case, the Court

⁸ James M. Wright, *Floodplain Management: Principles and Current Practices*, (University of Tennessee-Knoxville: 2007), 1–5 to 1–6; James M. Wright, *The Nation's Responses to Flood Disasters: A Historical Account*, (Association of State Floodplain Managers: Apr, 2000), 3; *Floodplain Management in the United States: An Assessment Report*, Federal Interagency Floodplain Management Task Force, 1992, 8–9.

⁹ Wright, *Floodplain Management* (2007), 1–4, 1–9; *Flood Hazards—A National Threat*, (2006).

¹⁰ Interagency Floodplain Management Review Committee (FMRC), *Sharing the Challenge: Floodplain Management into the 21st Century* (Washington D.C: U.S. Government Printing Office, June 1994); Gerald E. Gallaway, Jr., "Corps of Engineers Response to the Changing National Approach to Floodplain Management Since the 1993 Midwest Flood," *Journal of Contemporary Water Research and Education* 130, (Mar 2005): 5–12; Wright (2000).

ruled in favor of permitting the federal government to finance improvements to rivers. The debate continued throughout the 1800s, but due to large costs of flood control efforts and the impact of the Civil War, Congress failed to support major flood control initiatives. The reluctance persisted until the vast devastation of the Great Flood of 1927 along the lower Mississippi River united the nation on the topic of flood control. The Great Flood of 1927 flooded approximately 20,000 square miles, left more than 700,000 people homeless, caused over \$236 million of property damage, and had an official death toll of 246. The flood was one of the greatest natural disasters due to its broad impact and the great extent of human suffering it caused.¹¹

Several federal acts and initiatives followed the Great Flood of 1927, and in 1936 Congress passed The Flood Control Act of 1936. This Act was significant because it specifically identified flood control as a national interest and legitimized flood control as a federal activity.¹²

Since the 1936 Act, the federal role has grown amid strong public support to minimize the direct and indirect impacts of floods. Further justification for federal involvement in flood control is based on the realization that flood control measures in one state or region can adversely affect flood-control efforts in other states or regions. Despite the consensus support for a federal role in flood control, state and local governments must still take local responsibility for flood control and damage mitigation.¹³

Critics of the shared approach between all levels of government cite funding issues and an ambiguous delineation of responsibilities (and blame) following a disaster. Though these two challenges have been addressed as the legislation addressing flood control has evolved, proponents at all levels of governments are asking for more federal involvement while critics call for a decreased federal government role. Those critics claim that too much government oversight limits the states' capabilities to employ

¹¹ Betsy A. Cody and Nicole T. Carter, *Flood Risk Management and Levees: A Federal Primer*, CRS Report RL3329 (U.S. Congressional Research Service: June 20, 2008), 2–3; Wright (2000), 4–10.

¹² Wright, *Floodplain Management* (2000), 11–12.

¹³ Cody and Carter, *Flood Risk*, 3.

specific measures to counter the problems unique to their areas. While maintaining the federalist system in which our nation thrives is important, the interstate and national impacts of floods and flood control efforts demand continued involvement by the federal government. The key is to ensure states maintain control over activities that cannot adversely affect other states while the federal government encourages cooperation between states and provides national-level resources to help all states successfully employ flood control measures.¹⁴

With respect to response, the role of the federal government compared to, and in conjunction with, state and local governments is also a central subject of debate. Large-scale disasters garner mass media attention, and the public often looks for explanations as to the cause of the disasters. These disasters also lead to great scrutiny of the response efforts at all levels of government. In the case of the Great Flood of 1993, the federal government's response has been considered favorable on most accounts.¹⁵ An example of such praise came in a New York Times article published during the floods:

By almost every measure, Mr. [James Lee] Witt's early performance managing the flood response is being received well by flood survivors, local officials and members of the agency's staff, who are running field offices and aid centers in five states.¹⁶

¹⁴ Cody and Carter, 2–3; Jena Baker McNeill, “Beltway-Centric Approach to Disaster Response Is a Recipe for Disaster” (Washington, D.C.: Heritage Foundation, June 18, 2008); Wright (2000); *Sharing the Challenge*; Galloway, 7; Georgianne Nienaber, “Is ‘Mother Nature’ really to Blame for the Midwest Floods,” http://www.alternet.org/water/88355/is_'mother_nature'_really_to_blame_for_the_midwest_floods/ (accessed 8/17/2008, 2008); Richard Weitz, “Federalism and Natural Disasters: A Balanced Approach” (Washington, D.C.: Hudson Institute, 2006), 10–12, 15–16.

¹⁵ Peter G. Gosselin, and Allen C. Miller, “Why FEMA was Missing in Action - Los Angeles Times,” <http://www.latimes.com/news/nationworld/nation/la-na-fema5sep05,0,2650635,full.story?coll=la-home-headlines> (accessed 8/19/2008, 2008); Keith Schneider, “THE MIDWEST FLOODING; In This Emergency, Agency Wins Praise for its Response,” <http://query.nytimes.com/gst/fullpage.html?res=9F0CE6DD1531F933A15754C0A965958260> (accessed 8/18/2008,).

¹⁶ James Lee Witt was the director of FEMA during the 1993 floods.

Initial impressions of the federal government's response to the 2008 floods are also positive. By using source data and interviews to examine response efforts during the 2008 floods, this thesis provides a fresh perspective on the government's disaster response capabilities in the post-Katrina era.¹⁷

Since 1993, the federal government has transformed FEMA. The majority of the changes that shape the organization today have occurred over the last six years. In 2002, the agency was part of a major overhaul of the nation's homeland security organization following the terrorist attacks of September 11, 2001 (9/11). The National Security Act of 2002 placed FEMA under the newly formed Department of Homeland Security (DHS). Opponents of this move felt emergency response capabilities of FEMA would be dwarfed in the massive DHS organizational structure and the fact that DHS's primary focus was counterterrorism. Proponents of the move hoped to leverage FEMA's strengths in dynamic national response to improve the nation's overall responsibility to protect the nation from all threats and provide an all-hazards response capability.¹⁸

DHS and FEMA faced their toughest test following the post-9/11 reorganization when Hurricane Katrina devastated the Gulf Coast of Louisiana and Mississippi in 2005. In response to harsh criticism of the federal government's response to this disaster, the Post-Katrina Emergency Management Reform Act of 2006 was passed to further refine the post-9/11 structure for federal response to national disasters. The Post-Katrina Act reorganized FEMA (again), directed creation of a national incident management system, and called for development of a consolidated national response plan. The last two components created a formal structure for active dialogue between the federal, state, local and tribal emergency management organizations. The post-Katrina efforts addressed criticisms of the federal government's response to national disasters. The objectives of implementing the components of the Post-Katrina Act were to ensure state and local

¹⁷ "Victims of Midwest Flooding Praise FEMA," http://www.usatoday.com/weather/floods/2008-06-23-fema_N.htm (accessed 8/18/2008, 2008); "FEMA Earns High Marks for Response to Midwest Flooding," <http://www.foxnews.com/story/0,2933,371085,00.html> (accessed 8/18/2008); Amanda Paulson, "After this Flood, FEMA Earns Praise," *Christian Science Monitor*, sec. USA, July 2, 2008.

¹⁸ Henry B. Hogue and Keith Bea, *Federal Emergency Management and Homeland Security Organization: Historical Developments and Legislative Options* CRS Report RL33369 (Washington, D.C.: U.S. Congressional Research Service: Aug 1, 2006), 20–22.

governments sustained their authorities under the U.S.'s federalist system while enabling a rapid federal response when state and local capacities are exceeded by a disaster. These changes balanced the need for initial state and local responses and the call for greater federal involvement, especially when local capabilities are overwhelmed. This latest change set the stage for emergency response efforts during the 2008 Midwest floods.¹⁹

The 2008 Midwest floods tested the latest FEMA organization and the plans and processes produced since the Great Flood of 1993. The response section in Chapter V of this thesis examines the impact of the major changes to the federal response capabilities by exploring a detailed example of interagency response during the 2008 floods. Examining the response capabilities and effects in the post-Katrina environment provides an initial data set to demonstrate how DHS and FEMA have improved and provides details to help overcome the negative narratives and perspectives of federal response capabilities as a result of Hurricane Katrina.

With respect to flood mitigation, a second debate emerges. This debate centers on the types of flood control measures to employ. The two types of measures are structural and non-structural. Structural measures include levees, dams, reservoirs, channel alterations, etc. Non-structural measures include buyout programs to move residences from floodplains, strict floodplain development policies, and regulations such as zoning ordinances, building codes, and land-protection laws.²⁰

Historically, structural flood control measures in the U.S. can be traced to the primitive mounds employed by Native Americans to protect their river settlements from flooding. As the population of the U.S. grew, so did use of structural measures to protect thriving river communities and rich farmland from flooding. A “structures-only” approach was the dominant form of flood control measures employed in the U.S. from the time the federal government first engaged in flood control activities in the 1800s through the first half of the 1900s. Proponents of intensive use of structural methods seek to optimize the benefits of living close to major water sources, believe an engineering

¹⁹ Hogue and Bea, 23–26; U.S. Congressional Research Service, *Federal Emergency Management Policy Changes After Hurricane Katrina: A Summary of Statutory Provisions* CRS Report RL33729 (Washington, D.C.: U.S. Congressional Research Service, Nov 15, 2006).

²⁰ Wright, *National Flood Programs*, (2007), 7–2.

solution can solve all problems, and maintain that the benefits from this approach clearly outweigh the costs of employing the structural measures.²¹

There are several arguments against the structures-only approach to flood mitigation. Opponents contend the cost of construction and maintenance of flood control structures is too high. The second argument focuses on the impact of the structural flood controls on the environment. This opposition cites the negative impact of the measures on the floodplains and claims the floodplains have natural and environmental benefits that extend beyond the commerce and convenience achieved through further human exploitation. This opposition also argues the employment of structural measures encourages greater development in flood-prone areas by creating a false sense of security. This, in turn, puts more people and property at risk and results in more devastating effects when floods exceed the capabilities of the structural measures employed. The final opposition to the structures approach insists the approach is simply too narrow. The Great Flood of 1927 is often cited as the classic example of the devastation that can occur as a result of a narrow, structures-only approach to flood control. Prior to 1927, the majority of flood-control efforts were centered on a “levees-only” approach. Devastation from the floods in 1927, as detailed earlier, was the evidence needed to demonstrate the futility of a narrow, structures-only approach to flood control.²²

Non-structural mitigation measures emerged due to the realization that structures could not provide complete protection from the damaging effects of floods. The academic foundation for the non-structural philosophy comes from *Human Adjustment to Floods* by Gilbert F. White, published in 1945. The philosophy, which coincides with a nomenclature shift from “flood control” to “floodplain management,” calls for a two-pronged approach to minimize the impact of floods on personnel and property while optimizing both the natural and human benefits gained from the floodplains. Proponents insist portions of the floodplains must be protected to sustain the quality and availability of ground and surface water sources, to provide natural flood and erosion control, and to

²¹ Wright, *Floodplain Management* (2000), 4, 10–12.

²² Wright (2000), 9, 14; Association of State Flood Plain Managers (ASFPM), *National Flood Programs and Policies in Review-2007*, (Madison, WI: ASFPM, 2007), 7; *Floodplain Management in the United States* (1992), 8–9.

provide a natural environment for flora, fish, and wildlife. Proponents of the floodplain management philosophy do not discount the commercial and agriculture values of floodplains. Instead they propose a carefully calculated balance of non-structural and structural measures that sustains the natural benefits of the floodplains and protects commercial and agricultural interests in the area. Opponents to this philosophy discard the natural flood control value of the floodplains, claim the proponents are sacrificing the needs of humans and basic property rights to protect the environment, and push for greater commercial and agricultural development of the floodplains.²³

Since White first published *Human Adjustment to the Floods* in 1945, flood mitigation efforts at all levels of government have included a more balanced approach with respect to structural and non-structural measures. However, until the Great Midwest Flood of 1993, the scale was still tipped towards the structural approach. The emphasis has since changed in response to the impact of the 1993 floods and in response to the Interagency Floodplain Management Review Committee's study and 1994 report on the floods. Non-structural measures and environmental factors now receive equal or greater consideration than structural measures as part of an integrated flood mitigation strategy that utilizes a risk-reduction approach.²⁴

E. METHODS AND SOURCES

A comparative case study to evaluate whether U.S. federal flood mitigation and response efforts have improved since the Great Midwest Flood of 1993 is used to address the core questions of this thesis. The 1993 floods and the 2008 floods were studied within a specific area of the U.S. (Iowa). Iowa was selected because it was the center of

²³ Wright, *Floodplain Management* (2000), 14–20, 76; Wright (2007), 7–14, 8–1 thru 8–2; *National Flood Programs* (2007), 7–9; *Floodplain Management in the United States* (1992), 8–9; *Sharing the Challenge* (1994), 93–126; Mattoon.

²⁴ Wright (2000), 80–83; *National Flood Programs* (2007), 8; *Sharing the Challenge* (1994); Galloway (2005), 9. Cody and Carter, 7.

both disasters and both floods inflicted heavy damages to a large geographic portion of the state. The entire state was declared a natural disaster area in 1993. In 2008, 83 of 99 counties were declared disaster areas.²⁵

Within Iowa, research focused along the Cedar River in the Northeastern Iowa County of Black Hawk. The Cedar River experienced record flood levels in the 2008 floods and Black Hawk County was declared a presidential disaster area in both 1993 and 2008. Black Hawk County is Iowa's fourth largest county in terms of population and has a large population concentration located near the river in the Waterloo-Cedar Falls metro area. Black Hawk County was contacted directly to seek source data detailing structural and non-structural mitigation efforts since 1993, emergency response details of the floods in 2008, and economic information. Due to heavy reliance on the availability of primary sources, especially considering the recent nature of the 2008 floods, Black Hawk County emerged as the most complete case to address the questions of this thesis.²⁶

The evaluation of the cases compared the impact of the two floods on Black Hawk County, detailed the types and scope of mitigation efforts during the fifteen-year period to determine what worked best, and provided insight on response operations during the flood response in 2008. Evidence that FEMA actively promoted balanced mitigation efforts since 1993 and the effect of FEMA-promoted mitigation efforts on decreasing damage caused by the 2008 floods was sought. The examination of the response during the 2008 floods focused on interagency efforts and employment of post-Katrina disaster response concepts and structures.

In addition to the sources identified in the literature review, I also used data from FEMA, the U.S. Army Corps of Engineers, and emergency management organizations in Iowa at the state and local level for mitigation efforts between 1993 and 2008 floods and response efforts during the 2008 floods. Specifically with respect to the

²⁵ Mason Booth Judge, "Looking Back: The Great Midwest Floods of 1993," <http://www.redcross.org/news/ds/floods/030806midwest93.html> (accessed 8/18/2008).

²⁶ "Black Hawk County Online," <http://www.co.black-hawk.ia.us/about.html> (accessed 8/28/2008); "Linn County," http://www.co.linn.ia.us/content.asp?Page_Id=230 (accessed 8/28/2008,).

two floods, data on the scope and impacts of the floods was used for the comparative case study. Given the recent nature of the 2008 floods, my research depended largely upon primary source data and media reports.

F. THESIS ORGANIZATIONAL OVERVIEW

The thesis is organized in six chapters. The first chapter introduces the thesis by presenting the research question, initial hypothesis, relevance of the study, and the literature review. The background chapter follows the introduction and provides historical and current information on the federal role in flood mitigation. Chapters III and IV provide specific details of the Great Floods of 1993 and 2008. These chapters present overall characteristics and impacts of the two floods and specific impacts Iowa. Chapter V provides the analysis of the two floods from a macro scale and works towards a micro-level evaluation of differences in Black Hawk County. The micro-level evaluation details mitigation efforts in the county since the floods in 1993, the impact of the efforts in light of the 2008 floods, and examines the 2008 response to the floods. The final chapter draws conclusions based on the analysis of the two cases, makes recommendations to enhance future federal flood mitigation and response efforts, and identifies areas for further study.

This organization first provides a chronological order to demonstrate historical background of the federal role in flood mitigation and disaster response along with the facts of the two historic floods. The analysis focuses on a specific area, Black Hawk County, to create a foundation for comparing the effectiveness of the inter-flood mitigation efforts and provide insight of the 2008 flood response efforts in the post-Katrina era. The analysis highlights positives and negatives associated with federal investments in mitigation over the course of the fifteen years between the cases. It also provides a first look into the impact recent federal changes have had on local disaster response. The results from the comparative analysis provide the foundation of the recommendations to be presented in the final chapter.

II. BACKGROUND: FLOODS AND FEDERAL AGENCIES

A. INTRODUCTION

Floods are natural phenomena that occur when streams, rivers, and lakes overflow their banks. In the context of natural disasters, floods are defined by the amount of damage they cause to people or property. If people did not inhabit flood-prone areas, the natural phenomena of a river exceeding its notional capacity and overflowing into the surrounding areas, often referred to as floodplains, would preclude floods from being labeled a natural disaster. However, flood-prone areas are attractive for human settlements for a variety of reasons. Some of the reasons are transportation, readily available water supplies, power production, rich soils for agriculture, and for the simple beauty of the surrounding areas. In short, people populate the flood-prone areas for human convenience.²⁷

Because of the value and convenience, the U.S. has a large number of developments in flood-prone areas. Fifteen percent of the nation's urban areas are subject to flooding, and approximately \$900 billion in property and 10 million households are subject to the risk of floods. Floods cause an average of \$6 billion of property damage and claim 140 lives each year. According to the U.S. Geological Survey (USGS), floods are the nation's greatest natural disaster, and floods prompt more Presidential disaster declarations per year than any other hazard. Due to the scope of the threat and the enormous amount of damage caused by floods each year, floods and floodplain management receive a great deal of attention at the local, state, and national levels.²⁸

²⁷ Wright, *National Flood Programs*, (2007), 1–5 to 1–6; Wright, *Floodplain Management*, (2000), 3; *Floodplain Management in the United States: An Assessment Report*, Federal Interagency Floodplain Management Task Force, 1992, 8–9.

²⁸ Interagency Floodplain Management Review Committee (FMRC), *Sharing the Challenge: Floodplain Management into the 21st Century* (Washington D.C: U.S. Government Printing Office, June 1994); Gerald E. Gallaway, Jr., “Corps of Engineers Response to the Changing National Approach to Floodplain Management Since the 1993 Midwest Flood,” *Journal of Contemporary Water Research and Education* 130, (Mar 2005): 5–12; Wright (2000). Wright (2007), 1–4, 1–9; *Flood Hazards—A National Threat*, (2006).

This chapter details background information in the areas of flood mitigation and disaster response in the U.S. by explaining the evolution of the federal government's role in both areas. This section explains federal roles in flood mitigation and disaster response during the Great Midwest Floods of 1993 and 2008. Next, the chapter details the current federal roles in flood mitigation and disaster response and provides an overview of the four primary federal agencies at the time of the Great Midwest Floods of 2008. This chapter provides a baseline of the federal government's role in flood mitigation and response for the comparative analysis in chapter 5.

B. EVOLUTION OF FEDERAL ROLE IN FLOOD MITIGATION AND DISASTER RESPONSE

The definition of flood mitigation can vary based on the context in which it is used. In the context of this thesis, flood mitigation includes all efforts to minimize the damage caused by the natural phenomenon of floods while optimizing the use of flood-prone lands, or floodplains. The federal government roles prior to a flood include floodplain management and flood protection activities. Floodplain management entails actively managing flood-prone lands to optimize their benefits to people, natural habitats, and the environment while minimizing risks. Flood protection entails all efforts to protect personnel and property from flood damages. Protection efforts can employ structural methods, non-structural techniques, or a combination of both.

Federal efforts during and immediately following a flood include flood (disaster) response and recovery activities. Response is immediate assistance to minimize the risk to personnel and property and includes activities such as assisting with evacuations, strengthening existing flood protection structures, and providing food, water and shelter for displaced personnel. Recovery entails restoration of services, repairing damaged property, and restoring the community to a level equal to or greater than it was prior to the disaster. Examples of immediate recovery actions are re-opening transportation routes such as navigation channels, rail lines, roads and bridges; restoring power and

water supplies; and providing temporary housing. The following two sections provide an evolution of federal roles in flood mitigation and disaster response.²⁹

1. Federal Role in Flood Mitigation

The federal role in flood mitigation has evolved since first introduced on the national stage in the 1800s. The debate officially reached the national stage in 1824 when the U.S. Supreme Court heard *Gibbons v. Ogden*. The case involved New York state laws that favored in-state businesses on New York waterways and out-of-state businesses who protested the state laws. The case ruled in favor of the out-of-state defendant (Gibbons) and secured the federal government's role in regulating interstate commerce by citing Article I, Section 8 of the Constitution. The "Commerce Clause" of Section 8 grants the federal government the right "to regulate commerce with foreign nations, and among the several states, and with the Indian tribes."³⁰ While the focus on the ruling was reinforcing the federal role in regulating interstate commerce, the Court also ruled in favor of permitting the federal government to finance improvements to rivers on the same grounds since rivers facilitated interstate commerce.³¹

The *Gibbons v Ogden* ruling affirmed the Constitutional authority of Congress to regulate interstate commerce, and the ruling was applied so the federal government could play an active role in both channel navigation and flood control, including financing protection endeavors. However, large costs of flood control efforts and the Civil War, delayed active federal participation in major flood control initiatives through the 1800s. This changed following the Great Flood of 1927 along the lower Mississippi River. The Great Flood of 1927 flooded approximately 20,000 square miles, left more than 700,000 people homeless, caused over \$236 million of property damage, and had an official death toll of 246. The flood was one of the greatest natural disasters due to its broad impact and the great extent of human suffering it caused.³²

²⁹ Wright, *National Flood Programs*, (2007), 1–8 to 1–9, 7–8 to 7–14.

³⁰ U.S. Constitution, Article 1, Section 8; Wright, *Floodplain Management*, (2000), 4.
http://www.archives.gov/exhibits/charters/constitution_transcript.html (accessed 12/26/2008).

³¹ Cody and Carter (2008), 2–3; Wright (2000), 4–10; and Wright (2000), 11–12.

³² Cody and Carter (2008), 2–3; Wright (2000), 4–10.

The widespread damages and national attention from the 1927 flood united the nation on the topic of flood control. The momentum favoring federal involvement in flood control continued following the 1927 floods, and a significant milestone in federal flood mitigation was achieved in 1935 with the enactment of The Flood Control Act of 1936. The 1936 Act went beyond the simple acceptance of federal flood control efforts as contained in the *Gibbons v. Ogden* ruling and specifically identified flood control as a national interest and legitimized flood control as a federal activity. In short, justification for federal involvement in flood control in the U.S. federalist system is based on the realization that flood control measures in one state or region can adversely affect flood-control efforts in other states or regions and is supported by the Commerce Clause of the U.S. Constitution.³³

The role of federal government in flood control does not dissolve state and local governments from their responsibilities in the overall effort. State and local governments cannot simply rely on the federal government to provide protection. Governments at all levels, along with individuals who inhabit the U.S. floodplains must take local responsibility for flood control and damage mitigation. The key is for them to work with the federal government to ensure local efforts neither disrupt larger federal flood protection endeavors nor disrupt interstate commerce along the nation's waterways.³⁴

Since the mid-1800s, the lead federal agency for fulfilling the Constitution requirements of the federal government with respect to flood control has been the U.S. Army Corps of Engineers (USACE). Following a modest start, the USACE role in flood protection began in earnest in the early 1900s. In 1928, USACE began work on the Mississippi River and Tributaries Flood Control Project, and the Flood Control Act of 1936 specifically assigned USACE the role of flood protection for the entire country.³⁵

³³ Betsy A. Cody and Nicole T. Carter, *Flood Risk Management and Levees: A Federal Primer*, CRS Report RL3329 (U.S. Congressional Research Service: Jun 20, 2008), 2–3; Wright (2000), 4–10; and Wright (2000), 11–12.

³⁴ Cody and Carter, *Flood Risk*, 3.

³⁵ “Civil Works Program,” <http://www.usace.army.mil/public.html> (accessed 12/26/2008).

Today, USACE flood control efforts range from small, local protection projects (levees or non-structural flood control measures) to major dams. Most flood protection projects are constructed by USACE on a national-state cost share basis and owned by local authorities once construction is complete. However, USACE does retain ownership of some major flood protection projects and levees. For example, USACE currently maintains and operates 383 flood control dams and reservoirs. USACE flood protection efforts are credited with preventing \$208 billion of damage over the 10-year period from 1991 to 2000.³⁶

Historically, USACE has been the principal federal agency in flood control projects. However, they are not the only federal agency involved in flood protection. Since the early 1900s, the U.S. Departments of Interior (through the U.S. Geological Survey), Commerce (through the National Oceanic and Atmospheric Administration), and Agriculture have supported and augmented national flood control efforts.³⁷

2. Federal Role in Flood (Disaster) Response

The federal role in disaster response has evolved in parallel to the federal role in flood mitigation. Federal disaster response is not limited to floods, and disaster response has evolved over the years as a result of both human threats such as nuclear or terrorist attacks and natural threats such as earthquakes, fires, hurricanes, and floods.

In 1803, the first national emergency management-related legislation was passed in response to devastating fires in Portsmouth, New Hampshire. This legislation was the first of its kind and opened the door for allocation of federal resources to state and local authorities in response to a disaster. Between 1803 and 1950, 125 reactionary pieces of national legislation related to disaster assistance were passed.³⁸

A milestone in federal emergency response and disaster assistance occurred in 1950 with the passage of the Federal Disaster Relief Act of 1950. This specifically

³⁶ “Civil Works Program,” <http://www.usace.army.mil/public.html> (accessed 12/26/2008).

³⁷ “USGS: Postwar and Cold War,” <http://pubs.usgs.gov/circ/c1050/post.htm> (accessed 12/26/2008).

³⁸ “Disaster Management in the 21st Century,” *Crisis and Emergency Management Disaster Newsletter Vol 1 Number 3*, Dec 1, 2001, George Washington University (GWU).

authorized federal assistance to state and local governments while still protecting the federalist principles of government. The Act maintained state and local responsibilities for disaster response and clarified that federal assistance was available as a supplement to state and local governments. Furthermore, the Act required a state's governor to formally request federal assistance prior to the allocation of any federal resources and stipulated the governor's request could not be made until the state and local governments had committed their resources. The Disaster Relief Act of 1950 changed the way the federal government approached disaster response and paved the way for many changes over the next 40 years.³⁹

From 1950 to 1969, disaster response was primarily focused on civil defense amid fears of a possible nuclear attack. The Disaster Relief Act of 1969 bridged the gap between civil defense and natural disasters by including provisions for federal aid to local authorities in the preparation and planning for assistance during natural disasters. The 1969 Act also appointed a federal coordination officer for major disasters. The Disaster Relief Act combined with executive orders during President Richard M. Nixon's administration (1969-1974) disbursed emergency functions to separate agencies based on the nature of the disaster and type of assistance required.⁴⁰

Delineating emergency management responsibilities by disbursing them among several government agencies did not achieve the desired effect. In 1978, the National Governors' Association (NGA) released the most notable policy position criticizing the state of national preparedness for disasters and emergency management. The NGA's policy position called for a comprehensive approach to preparedness and emergency response that was organized under a single office designated to coordinate all federal efforts in these two areas. President Carter responded to the request by issuing an executive order (Exec Order 12127) in March of 1979 that established FEMA as an independent agency. The order initially placed preparedness and response functions from the Department of Commerce, the Department of Housing and Urban Development,

³⁹ "Disaster Management in the 21st Century"; Hogue and Bea, 5.

⁴⁰ Hogue and Bea, 7-13

(HUD), and the President to the new agency. A follow-up order later that year transferred additional functions to FEMA from the Departments of Defense, HUD, and the General Services Agency (GSA).⁴¹

FEMA struggled to organize and define itself as an infant agency throughout the 1980s. In 1989, the Loma Prieta Earthquake and Hurricane Hugo challenged the agency and produce mixed results. While the media was harsh on the agency's performance, a 1991 study by the Government Accountability Office (GAO) found that FEMA performed according to its statutory requirements. The GAO identified shortcomings in the emergency response of FEMA along with state and local authorities. Finally, the report also noted that FEMA appeared unprepared for the long-term recovery effort of a major disaster.⁴²

FEMA faced further criticism in response to Hurricane Andrew in 1992. The 1992 failures led to a congressionally mandated study of national, state, and local authorities' abilities to respond to a major national disaster. The National Academy of Public Administration (NAPA) conducted the study.⁴³

The NAPA study was released in February 1993 and recommended seven essential conditions for success based on a more direct connection to the President and an organization that enabled clear direction during disasters and better intra- and inter-agency coordination. The GAO released a second report on FEMA in July 1993 that recommended organizational changes in sync with the NAPA study. The GAO report also led to recommendations that FEMA transition from a focus on response to a nuclear disaster to responding to all types of disasters.⁴⁴

In 1993, President Clinton appointed James L. Witt as Director of FEMA. Director Witt was the first leader of FEMA with a background in emergency management. He reorganized FEMA in accordance with the recommendations of the

⁴¹ Hogue and Bea, 7–13.

⁴² Ibid. 14–16.

⁴³ Ibid.

⁴⁴ Ibid. 16.

NAPA study and 1993 GAO report. President Clinton made further improvements to FEMA in 1996 when he announced his decision to include the FEMA director as a sitting member of his cabinet. This was the first time the FEMA director was included as a cabinet member. However, President George W. Bush ended the practice after only five years when he took office in 2001.⁴⁵

Despite a positive evolution into a national disaster response agency in the 1990s, FEMA's abilities were still questioned in the late 1990s. A February 2001 report from the Hart-Rudman Commission recommended 50 changes to the U.S. government. The Commission's second recommendation proposed to create a National Homeland Security Agency (NHSA). The NHSA would be a cabinet-level position that included FEMA as its core organization for emergency preparation and response. The Commission hoped to build on FEMA's successes and strengths with respect to natural and manmade disasters. The Commission's recommendations were not initially adopted. However, the terrorist attacks on September 11, 2001 led to the passage of the Homeland Security Act of 2002, which created the Department of Homeland Security (DHS). The act also enacted the core recommendations of the Hart-Rudman Commission and opened the door for FEMA's transfer to DHS. On March 1, 2003, FEMA was formally transferred to DHS.⁴⁶

The new, DHS-aligned FEMA organization faced their toughest natural disaster test following the post-9/11 reorganization when Hurricane Katrina struck the U.S. Gulf Coast in 2005. In response to harsh criticism of the federal government's response to this disaster, Congress passed the Post-Katrina Emergency Management Reform Act of 2006. The Post-Katrina Act addressed criticisms of the federal government's response to national disasters. Implementation of the Post-Katrina Act set the stage for emergency response efforts during the 2008 Midwest floods.⁴⁷

⁴⁵ Hogue and Bea, 15–16; and “FEMA History,” <http://www.fema.gov/about/history.shtm> (accessed 11/28/2008).

⁴⁶ Hart Rudman Commission was chartered by the Department of Defense in mid-1998 as the U.S. Commission on National Security/21st Century and was chaired by two former Senators, Gary Hart and Warren B. Rudman. The Commission issued three reports. Its final report was issued in early 2001 and “included 50 recommendations for governmental changes.” Hogue and Bea, 19–22.

⁴⁷ Hogue and Bea, 23–26; U.S. Congressional Research Service, *Federal Emergency Management Policy Changes After Hurricane Katrina: A Summary of Statutory Provisions* CRS Report RL33729 (Washington, D.C.: U.S. Congressional Research Service, November 15, 2006).

C. PRIMARY FEDERAL AGENCIES FOR FLOOD MITIGATION AND DISASTER RESPONSE IN 2008

The 2008 Midwest floods tested the latest FEMA organization and the plans and processes produced since the Great Flood of 1993. However, FEMA is not the only federal agency to evolve with respect to flood mitigation. At the time of the 2008 floods, four federal organizations had a major role in flood mitigation. The four organizations are the U.S. Army Corps of Engineers (USACE), Federal Emergency Management Agency (FEMA), National Oceanic and Atmospheric Administration (NOAA), and the U.S. Geological Survey (USGS). The following section details the roles of these four agencies.

1. Federal Emergency Management Agency (FEMA)

FEMA has the largest federal role in overall flood mitigation. FEMA plays a large role in preparation and prevention of flood-related disasters and is the lead federal agency for response and recovery to all types of disasters in the U.S. FEMA takes a proactive approach to support state and local response efforts. In the response role, FEMA is primarily a supporting agency to state and local authorities. However, in the aftermath of a flood, FEMA plays a larger role by supporting all aspects of recovery including applying federal funds to assist disaster-stricken areas and identifying and supporting opportunities for future hazard mitigation activities.

a. FEMA: Preparation and Prevention

Prior to a disaster, FEMA has two main roles in the preparation and prevention roles of mitigation. First, FEMA is the executive agency for the National Flood Insurance Program (NFIP). NFIP was established in 1968 to fill a void in the area of flood insurance that could not be provided by private insurers at an affordable rate. Congress established NFIP as a result of growing federal expenses for flood disaster relief and non-availability of flood insurance in the private sector. NFIP is provided to individuals and communities that meet the requirements of the program. NFIP requires new structures built in Special Flood Hazard Areas (SFHAs) to be elevated above the

100-year flood level. Existing structures are required to raise their elevation when they rebuild after experiencing flood damage of 50 percent or greater than the value of the property. Besides the benefit of insuring properties that could not previously be insured, NFIP provides FEMA a channel to enforce standards to prevent or minimize future flood damage. To this end, the program has evolved over the years to further support the goal of preventing future flood damage. The Flood Disaster Protection Act of 1973 added the restriction that federally backed loans could not be awarded for facilities in flood-prone areas unless flood insurance was purchased. In short, NFIP is FEMA's tool to offset government expenses following a disaster and regulate how floodplains are used in order to minimize future damages from floods.⁴⁸

The enactment of the National Flood Insurance Reform Act of 1994 further strengthened financial restrictions for lenders in a flood-prone area and added another tool for FEMA in the area of preparation for and prevention of floods, the Flood Mitigation Assistance Program (FMA). FMA is available to state and local structures covered by NFIP. FMA is designed to implement long-term solutions to mitigate flood hazards. FMA has three types of funding available: planning, project, and technical assistance grants. FMA grants are authorized on an annual basis and are not directly tied to a specific disaster. The Bunning-Bereuter-Blumenauer Flood Insurance Reform Act of 2004 provided FEMA two additional hazard mitigation programs that are not tied to specific disasters. The Repetitive Flood Claims (RFC) grant program allows FEMA to provide up to \$10 million in RFC funds to assist state and local communities mitigate flood risks for properties that have had one or more claims to NFIP. RFC funds can be used to acquire flood-zone properties (relocations), property elevations, or similar types of flood proofing measures. FEMA can fund the total amount of an RFC grant if the project can not be funded by a FMA grant because either the state can not pay the 25 percent cost-share required by FMA or the local capacity to manage the project. The Severe Repetitive Loss (SRL) grant program is the second mitigation tool provided to

⁴⁸ Lloyd Dixon, et al., *The National Flood Insurance Program's Market Penetration Rate: Estimates and Policy Implications* (Arlington, VA: RAND Corporation, 2006), xv, 1; Rawle O. King, *Federal Flood Insurance: The Repetitive Loss Problem* CRS Report RL32972 (Washington, D.C.: U.S. Congressional Research Service: June 30, 2005), 6–8, 17–18, and 22–24.

FEMA with enactment of the Flood Insurance Reform Act of 2004. SRL defines properties eligible under this program as a residential property that is covered by a NFIP flood policy and has either four or more NFIP claim payments over \$5,000, or at least two separate claims payments that exceed the market value of the building when their amounts are combined. Acquisition or relocation of properties, elevating existing structures, minor flood reduction projects, and flood proofing historical properties are the projects eligible for grants under the SRL grant program. FEMA funds 75 to 90 percent of the projects under the SRL program, and state or local authorities must pay the remaining percentage. To further encourage proactive mitigation efforts at the state and local levels, FEMA only provides funds at the 90 percent level to states with FEMA-approved Standard or Enhanced Mitigation Plans. The SRL and RFC grant programs share the purpose of reducing or eliminating NFIP claims by funding projects that provide the greatest savings to the National Flood Insurance Fund.⁴⁹

FEMA has one more tool to help fund state and local projects designed to mitigate the damages caused by floods. Similar to the three previously mentioned grant programs, the Hazard Mitigation Grant Program (HMGP) provides funds for states and local governments to implement long-term hazard mitigation measures after a major disaster declaration. HMGP's purpose is to reduce the damaging effects of natural disasters to personnel and properties and implement flood protection measures during the immediate recovery from a disaster. In 1988, the Robert T. Stafford Disaster Relief and Emergency Assistance Act authorized the HMGP.⁵⁰ HMGP is administered by the individual states. FEMA funds HMGP grants and provides oversight to ensure projects meet the specific statutory requirements such as: projects must provide a long-term solution to a specific risk, meet NFIP requirements for properties in a flood-prone area, and federal environmental regulations. Examples of projects funded by HMGP are

⁴⁹ "FEMA: Mitigation Grant Programs," http://www.fema.gov/government/grant/fs_mit_grant_prog.shtm (accessed 12/1/2008).

⁵⁰ The Stafford Act was originally passed in 1988 as an update to the Disaster Relief Act of 1974. Amendments to the Stafford Act in 1993 included the ability of FEMA to acquire properties in flood plains (buyouts). Further amendments added in the period between 1994 and 2007 strengthened the pre-disaster mitigation abilities of FEMA. Ibid; and *Robert T. Stafford Disaster Relief and Emergency Assistance Act, as amended, and Related Authorities* as of June 2007.

property acquisition and (voluntary) personnel relocation for private residents, elevating existing structures at least one foot higher than the 100-year flood level, and installing floodwalls to protect critical facilities. HMGP is the final tool in the arsenal of hazard mitigation capabilities provided to FEMA to mitigate the effects of floods during the preparation and prevention phases.⁵¹

b. FEMA: Response and Recovery

Formally established in 1979, FEMA has been the centerpiece of federal response to all forms of major disasters in the U.S. Since 1979, it has continued to face scrutiny by the public, legislators, and the media in the aftermath of disasters. As a result, FEMA and its roles in national response and recovery have evolved in sync with changes to the overall federal structure and in response to lessons from major disasters. Since the 1993 Midwest Floods, FEMA has undergone two major overhauls. The first was moving it into the newly formed Department of Homeland Security (DHS) by the National Security Act of 2002. The Post-Katrina Emergency Management Reform Act of 2006 enacted the second major overhaul in an effort to correct deficiencies identified during Hurricane Katrina in the August of 2005. The Post-Katrina Act reinforced the goals and direction provided to emergency responders by the National Security Act of 2002 and Homeland Security Presidential Directive (HSPD-5), *Management of Domestic Incidents*.⁵²

The National Security Act of 2002, HSPD-5, and Post-Katrina Act did more than simply realign federal resources for national response to disasters. All three called for a national approach to address both manmade and natural disasters in the U.S. and directed DHS to codify a national approach that ensured interagency cooperation at the federal level and included state, local, and tribal governments and emergency

⁵¹ “FEMA: Mitigation Grant Programs,” http://www.fema.gov/government/grant/fs_mit_grant_prog.shtm (accessed 11/1/2008); and FEMA “HMGP Factsheet,” Spring/Summer 2008.

⁵² Hogue and Keith, 20–26; U.S. Congressional Research Service, *Federal Emergency Management Policy Changes After Hurricane Katrina: A Summary of Statutory Provisions* CRS Report RL33729 (Washington, D.C.: U.S. Congressional Research Service, Nov 15, 2006); *National Response Framework*, Washington, DC: Government Printing Office, Jan, 2008; and *National Incident Management System: Pre-Decisional Draft*, Washington, DC: Government Printing Office, April 2008.

responders. HSPD-2 specifically directed the Secretary of Homeland Defense to develop the *National Incident Management System* (NIMS) and a *National Response Plan* (NRP). In response to HSPD-5, NIMS was initially released by DHS on 1 March 2004 and the NRP was initially released in December 2004. Responding to lessons learned during Hurricane Katrina, both of these documents have been revised since the Post-Katrina Act was enacted in 2005.⁵³

The predecessor to the NRP was the *Federal Response Plan* (FRP), which was originally published in 1992. The NRP was the official federal document governing disaster response during the Great Midwest Floods of 1993. The NRP sought to build on FRP and correct its federal-level only approach by incorporating response responsibilities of state and local governments. In the aftermath of Hurricane Katrina, the NRP was updated and renamed the National Response Framework (NRF). The name was changed to better reflect its doctrinal approach that allows a situation-dependent, adaptive application when responding to a national disaster versus the strict adherence, detailed approach associated with a plan. The NRF also responded to critiques that deemed the NRP bureaucratic, internally repetitive, and still too focused on national-level response. The NRF was finalized and officially released on 22 January 2008, which made it the official federal guidance for disaster response during the Great Midwest Flood of 2008.⁵⁴

The NRF is built from the template of NIMS and provides guiding principles for preparation and response agencies at all levels. The NRF is scaleable and includes flexibility so it can be applied to small, local incidents and large-scale national disasters. NRF provides a comprehensive all-hazards approach to disaster response in the U.S. NRF describes roles, responsibilities, and common structures for a coordinated, effective response. It also provides the core principles of response and doctrinal foundation for all levels of disaster response. Twenty-three annexes augment the NRF core publication to provide procedures, structures, and operational concepts for all emergency response players during different types of disasters and emergencies. The NRF fits into a broader strategic hierarchy for the U.S. by filling one of the four primary

⁵³ *National Response Framework*; “FEMA: Mitigation Grant Programs”; and “National Response Framework Released,” http://www.dhs.gov/xnews/releases/pr_1201030569827.shtm (accessed 12/4/2008).

⁵⁴ *National Response Framework*; and “National Response Framework Released.”

goals of the *National Strategy for Homeland Security* published in October 2007. The NRF provides guidance to satisfy the strategy goal of ensuring the U.S. can “[r]espond to and recover from incidents,” which in this context means a manmade or natural disaster resulting from the hands of man or nature.⁵⁵

In conjunction with the efforts to replace the NRP with the NRF following Hurricane Katrina, the 2004 version of NIMS was also updated to benefit from the lessons learned. The updated version of NIMS retains the core principles of response from the earlier version and incorporates lessons learned from Hurricane Katrina. A pre-decisional draft of the updated NIMS dated 23 April 2008 was released for a final national comment period on 1 May 2008. As released for final comment, the updated document better reflected the normal emergency management process and placed a greater emphasis on preparation by moving it to the beginning of the document, expanded preparation and resource management roles, clarified concepts for response, and reflected the changes made and published in the final version of the NRF. The national comment period concluded 2 June 2008. The final version of NIMS incorporating these changes was published in December 2008.⁵⁶

DHS and FEMA used prior efforts in disaster response and existing systems in the field to formalize NIMS. In drafting NIMS, they leaned on organizations and benchmarked prior efforts from the Firefighting Resources of California Organized for Potential Emergencies (FIRESCOPE), the National Wildfire Coordination Group, and the National Inter-Agency Incident Management System to develop the Incident Command Structure (ICS) for NIMS. These documents served as the foundation for ICS principles in the 2004 version of NIMS and are retained in the published copy of the revised document.⁵⁷

⁵⁵ *National Response Framework; National Incident Management System: Pre-Decisional Draft*; and *National Strategy for Homeland Security*, Washington, D.C.: Government Printing Office, 2007.

⁵⁶ *National Incident Management System: Pre-Decisional Draft*; “NIMS Resource Center,” <http://www.fema.gov/emergency/nims/> (accessed 9/7/ 2009); and “NRF Resource Center,” <http://www.fema.gov/emergency/nrf/> (accessed 11/14/ 2009).

⁵⁷ Ibid.

NIMS provides a common template for federal, state, and local emergency responders to use in all phases of domestic disasters and emergencies: preparation, prevention, response, and recovery. NIMS details a unified approach to incident management and provides emergency responders with standard terminology and structures for command and management. NIMS is applicable in isolated local responses and multi-jurisdictional state and national disasters. NIMS is a proactive approach to ensure seamless cooperation and coordination of multiple departments and agencies during a disaster or emergency response to reduce the destruction of property, loss of life, or harm to the environment. Where the NRF provides structures and mechanisms to coordinate and integrate response activities, NIMS provides the all types and levels of emergency responders and leaders a common foundation for an integrated, all-hazards response. The NRF and NIMS are complementary documents designed to enhance the nationwide response to terrorist attacks, natural disasters, and all types of other emergencies.⁵⁸

2. U.S. Army Corps of Engineers (USACE)

The U.S. Army Corps of Engineers (USACE) has been involved in flood control since the 1800s. Initially, USACE was only responsible for flood control along the Mississippi River. USACE was given flood protection responsibilities for the entire nation by the Flood Control Act of 1936. Today, USACE has a key role during both routine operations and emergency situations. Flood control activities comprise one of the two major functions of USACE's Water Resources Program. All facets of USACE's comprehensive water resources program is managed in coordination with other federal agencies, state, and local officials.⁵⁹

⁵⁸ *National Incident Management System: Pre-Decisional Draft*; Homeland Security Presidential Directive 5 (HSPD-5) available at <http://www.whitehouse.gov/news/releases/2003/02/20030228-9.html> (accessed 4 December 2008); and "Frequently Asked Questions: NIMS Overview – Compliance," <http://www.fema.gov/emergency/nims/faq/compliance.shtm> (accessed 12/4/2008).

⁵⁹ Other functions of USACE's Water Resources programs include navigation, recreation, hydroelectric power, shore protection, dam safety, and water supply. "U.S. Army Corps of Engineers Missions: Water Resources," <http://www.usace.army.mil/missions/water.html> (accessed 23 November 2008); and "13 Tough Questions for the Army Corps of Engineers' Flood Reconstruction Chief - Popular Mechanics," http://www.popularmechanics.com/blogs/science_news/4270399.html (accessed 11/28/2008).

USACE flood control measures during routine operations include construction, operation, and maintenance of structural flood protection measures such as levees, floodwalls, reservoirs, and dams. USACE is responsible for a large portion of the federal government's construction of flood control infrastructure. USACE involvement is contingent on the project being deemed in the nation's interest and the cost sharing of costs between the federal government and state and local sponsors. Between 1991 and 2000, USACE flood protection measures prevented approximately \$208 billion in flood damage. USACE also provides advice and technical services to local communities, industries, and property owners to help them prevent flood damage. Despite a common misperception, USACE is not responsible for management and maintenance of all U.S. levees. USACE has oversight of approximately 2,000 levees nationwide, which accounts for nearly 9,000 miles of the U.S.'s 15,000 miles of levees. USACE also works with local sponsors to ensure levees are maintained to the appropriate flood protection level.⁶⁰

USACE is a key player leading to and during a major flood. Prior to a flood USACE lends assistance to protect personnel and property from a flood. USACE fulfills this role when a flood is imminent and the threat of damages is great if no action is taken immediately. These types of activities include strengthening federal and non-federal flood control structures and actively managing water released from reservoirs. USACE efforts are intended to augment state and local agencies, and they cannot commit to help without a written request from the state's governor or appointed representative.⁶¹

During a flood, USACE supports state and local response efforts by assisting with search and rescue operations, providing technical advice, conducting emergency repairs to levees and other flood control structures, and furnishing materials when USACE is actively participating in the flood control efforts or when local supplies are diminished.

⁶⁰ Cody and Carter, 1–3, 7–8; “Flood Control,” <http://www.vtn.iwr.usace.army.mil/floodcontrol/default.htm> (accessed 11/14/2009); and U.S. Army Corps of Engineers, *Civil Works Floodplain Management Initiatives: Value to the Nation* (Alexandria, VA: USACE, Institute for Water Resources, April 2000).

⁶¹ “Flood Control”; “FEMA & the U.S. Army Corps of Engineers (ESF #3) – 2008 Midwest Flood,” <http://www.mvr.usace.army.mil/PublicAffairsOffice/MidwestFlooding2008/FloodFEMA&Corps.htm> (accessed 11/6/2008); and “Emergency Operations,” <http://www.mvr.usace.army.mil/EmergencyMgt/EM-EmergOps.asp> (accessed 11/6/2008).

USACE remains active in these types of activities throughout the emergency situation and concludes its activities once flood waters have receded below a predetermined or critical stage.⁶²

USACE continues to assist disaster-stricken efforts in a post-flood response mode. This assistance is limited to major floods that cause major property damage and result in life-threatening situations. Post-flood assistance includes technical advice and assistance, identifying hazard mitigation opportunities, temporarily restoring critical public services, and clearing debris that blocks channels, structures, bridges, transportation routes, or water supplies. USACE's post-flood assistance can last no longer than 10 days from the date an official request for assistance is received from the governor and is intended to supplement overextended state and local resources.⁶³

3. U.S. Geological Survey (USGS)

USGS is primarily a supporting agency in the federal family of flood mitigation agencies. USGS supports flood mitigation as a scientific agency that delivers enabling products to the other federal agencies during normal and emergency situations. The goal of USGS is to apply an array of scientific disciplines to better predict natural hazards and decrease their devastating impact to personnel and property. With respect to floods, USGS provides the federal backbone for historical and real-time streamflow information. USGS-provided streamflow information is used by the National Weather Service (NWS) to forecast floods and issue warnings to affected areas. Real-time data enables NWS and other agencies to forecast the changing nature of floods during an event. This data helps local emergency managers respond to the disaster and manage the event to minimize the loss of life and property. The real-time data is also important to USACE decisions on floodwater management during emergencies. The historical data provided by USGS

⁶² "Emergency Operations."

⁶³ Ibid.

enables advanced modeling on the frequency and intensity of floods and contributes to accurate flood zone maps for programs such as NFIP and local zoning and development ordinances.⁶⁴

4. National Oceanic and Atmospheric Administration (NOAA)

NOAA's contribution to flood mitigation primarily comes from the efforts of the National Weather Service (NWS). The NWS provides severe weather, river and flood forecasts and warnings that contribute to real-time mitigation actions and assists emergency managers during disasters. The stated mission of the NWS is to protect life and property, and enhance the U.S. economy. NWS is "the sole official voice of the U.S. government for issuing warnings during life-threatening weather situations."⁶⁵ NOAA also contributes to flood mitigation by providing scientific information on the antecedent conditions that lead to floods such as soil saturation and unusual climatology trends in specific regions.⁶⁶

D. CONCLUSION

The federal government has many agencies involved in flood mitigation activities. FEMA is the lead for the majority of hazard mitigation grants and NFIP. USACE provides engineering for the majority of flood protection projects. NOAA and USGS provide technical support to optimize use of water sources, manage the floodplains, and provide flood forecasts. All four of these agencies also play a role in response and recovery activities. However, FEMA is the lead federal agency and fulfills DHS's statutory requirements for coordinating all federal efforts in these areas during a major disaster. In addition to the four

⁶⁴ *Natural Hazards: Minimizing the Effects*, USGS Fact Sheet 093-99 (U.S. Geological Survey: January 1999); and *Flood Hazards—A National Threat*.

⁶⁵ "NOAA - National Oceanic and Atmospheric Administration - Weather." <http://www.noaa.gov/wx.html> (accessed 11/28/2008); "NWS Headquarters Organization and Structure," <http://www.weather.gov/hdqrtr.php> (accessed 11/15/2009); and "Flood Losses," http://www.weather.gov/oh/hic/flood_stats/Flood_loss_time_series.shtml (accessed 12/9/2008).

⁶⁶ "NOAA - National Oceanic and Atmospheric Administration - Weather"; and "Climate of 2008 Midwestern U.S. Flood Overview," <http://www.ncdc.noaa.gov/oa/climate/research/2008/flood08.html#summary> (accessed 11/12/2009).

organizations mentioned, several other departments are involved in the federal activities associated with flood mitigation and response, including the Departments of Agriculture and Housing and Urban Development.

The team of federal organizations works together and with state and local governments to provide flood mitigation services and disaster response. The division of responsibilities has become clearer as the role of the federal government has evolved, which provides advantages such as sharing the workload and specializing in their areas of expertise. However, the large number of federal organizations makes coordination at the federal level more challenging and presents an unclear picture for state and local authorities, especially during emergency operations. The post-9/11 reorganization was designed to clarify some of the confusion and the Post-Katrina Act further clarified federal functions for major disaster response.

This chapter sets the stage for the remainder of the thesis by providing a brief historical background on U.S. federal organizations and their current status with respect to flood mitigation and disaster response. This chapter provides the baseline for the comparative analysis of the functions during the Great Midwest Floods of 1993 and 2008 in Chapter V.

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III. THE GREAT MIDWEST FLOOD OF 1993

A. INTRODUCTION

This chapter details the devastation of the Great Midwest Flood of 1993. At the time, the floods were the greatest natural disaster in U.S. history and considered the greatest flood in modern times.⁶⁷ Occurring over the summer of 1993, the floods affected nine states in the Midwest and led to disaster declarations for 532 counties in the affected region. The following chapter is divided into two sections. The first section details the overall impact of the 1993 floods in terms of scope and damages. The second section provides the same details specifically associated with Iowa. This chapter adds to the baseline for the comparison between the 1993 and 2008 floods.

B. THE FLOOD

The Great Midwest Floods of 1993 started in May, peaked in July, and persisted until August and beyond in some situations. The floods inundated portions of nine states and claimed approximately 50 lives. In his comprehensive review of the disaster, *The Great Floods of 1993: Causes, Impacts, and Responses*, Stanley A. Changnon puts the death toll at 52. Various government sources put the toll anywhere between 38 and 52.⁶⁸

⁶⁷ Hurricane Katrina in 2005 replaced the Great Floods of 1993 as the most devastating natural disaster in U.S. history. Hurricane Katrina caused more than \$81 billion damage, claimed more than 1,300 lives and displaced over 800,000 citizens in the U.S. Gulf Coast region. “Hurricane Katrina,” <http://www.hhs.gov/disasters/emergency/naturaldisasters/hurricanes/katrina/index.html> (accessed 12/1/2008); “Death toll from Katrina likely higher than 1,300,” <http://www.msnbc.msn.com/id/11281267> (accessed 12/6/2008); and “The First Year After Hurricane Katrina: What the Federal Government Did,” http://www.dhs.gov/xprepresp/programs/gc_1157649340100.shtm (accessed 12/6/2008).

⁶⁸ Stanley A. Changnon, *The Great Flood of 1993: Causes, Impacts, and Responses* (Westview Press: Boulder, CO, 1996), 3–4; Gary P. Johnson, Robert R. Holmes, Jr. and Loyd A. Waite, *The Great Flood of 1993 on the Upper Mississippi River—10 Year Later*, USGS Factsheet, May 2004; and Mason Booth, “Looking Back: The Great Midwest Floods of 1993,” <http://www.redcross.org/news/ds/floods/030806midwest93.html> (accessed 8/18/2008); and *Natural Disaster Survey Report: The Great Flood of 1993*, U.S. Department of Commerce, NOAA’s Disaster Survey Team, U.S. Printing, February 1994, 1–4.

In addition to the deaths, the floods caused tremendous amounts of suffering to the affected regions, displacing at least 54,000 people and causing an estimated \$18 billion in damage.⁶⁹

The floods of 1993 were a result of a unique hydro-meteorological event. First, the area's soils were heavily saturated due to a combination of an extremely wet period in the fall of 1992 and the runoff from the spring snowmelt. Between November 1992 and April 1993, Iowa experienced its second highest period of precipitation in 121 years. The inclement conditions and saturated soils prior to April of 1993 meant most rivers and streams were flowing above their seasonal averages. Second, the affected area was blanketed by higher-than-normal precipitation. From April to June 1993, the upper Mississippi River Basin experienced its wettest period in 99 years of observations. The combination of heavy precipitation and massive snowmelt was too much for rivers and streams already flowing above seasonal averages. The result was flooding in the Midwest that breached more than 1,000 levees and inundated more than 20 million acres in nine states. The floods affected more than fifteen percent of the contiguous United States, produced record flood observations at 95 forecasting points monitored by the National Weather Service (NWS), and observations above the flood level at 500 NWS flood forecasting points. The waters exceeded values for a 100-year (or 1 percent) flood at 45 streamflow gauges monitored by the U.S. Geological Survey (USGS). In short, the duration, area, and magnitude of the 1993 floods was extensive.⁷⁰

⁶⁹ As the flood evolved in 1993, leaders in the affected communities and states quickly realized the floods were more than an isolated event affecting them. Kristin White, "Signs of Olive Branch: Confronting the Environmental Health Consequences of the Midwestern Floods," *Environmental Health Perspectives* 101, no. 7 (Dec., 1993), 584–588; Johnson, Holmes, and Waite "The Great Flood of 1993 on the Upper Mississippi River—10 Years Later," USGS. Various numbers are used to quantify the monetary damages of the 1993 floods. Estimates range between \$5 and \$25 billion. The Galloway Commission ranged the damage between \$12 and \$16 billion; however, the report admits that its numbers were premature and not all encompassing. For consistency purposes, this thesis uses the \$18 estimate from *The Great Floods of 1993: Causes, Impacts, and Responses*. Changnon, 3.

⁷⁰ "The Great Flood of 1993," <http://mo.water.usgs.gov/Reports/1993-Flood/index.htm> (accessed 23 November 2008); Galloway Commission Report, 8–9; Johnson, Holmes, and Waite; *Natural Disaster Survey Report*, xvii, 1–1 thru 1–5; and Andrew Rosenthal and Dustin Devine, "Disastrous Floods a Part of Midwest History," http://weatherbug.excite.com/StormCentral/Excite/StormCentral.aspx?no_cookie_zip=30301&no_cookie_stat=ATF39&no_cookie_world_stat=&zcode=z4639&story_id=8170&lid=SCT4 (accessed 12/16/2008).

The floods completely inundated at least 75 towns. According to FEMA estimates, more than 70,000 houses were damaged or destroyed. By April 11, 1994, FEMA had approved 89,734 applications for assistance under the Disaster Housing Program, which indicates damage to individual residences from the floods was more likely higher than 100,000 houses.⁷¹

The floods challenged the full spectrum of federal, state, and local authorities. FEMA and the U.S. Army Corps of Engineers (USACE) were the principal federal agencies for response and recovery. Their efforts were directly assisted by at least six additional cabinet-level departments within the federal government. The floods served as an opportunity to rebound from the critical reviews of federal response during Hurricane Andrew in 1992, the first test for newly appointed FEMA director, James L. Witt, and reinforcement for the changes recommended by the NAPA study and 1993 GAO report. Director Witt passed his first test and the overall impression of federal response to the 1993 floods was favorable.⁷²

When the Galloway Commission's report was published in 1994, the estimated costs of direct federal expenditures for disaster response and recovery were \$4.2 billion. The total bill to the federal government also included more than \$1.3 billion in federal insurance payments and more than \$620 million in loans to individuals, businesses, and communities. The final tally for an estimated total of the federal costs for response and recovery to the Floods of 1993 was approximately \$6.2 billion. The cumulative cost to the affected states was \$1 billion, which puts the total costs of public expenditures for the response and recovery at greater than \$7 billion.⁷³ Figure 1 provides an overview of the nine affected states and highlights the emergency response costs for each of the affected counties.

⁷¹ "The Great Flood of 1993," <http://mo.water.usgs.gov/Reports/1993-Flood/index.htm> (accessed 12/16/2008); Galloway, 17; and *Natural Disaster Survey Report*, 1–4.

⁷² The following Departments were involved in federal response and recovery efforts during the 1993 floods: Department of Agriculture, Department of Housing and Urban Development, Department of Education, Department of Commerce, Department of Interior, Department of Labor, Department of Transportation, and the Environmental Protection Agency, Galloway 6–7, 20–25.

⁷³ Galloway, 22–28 and Changnon, 7.

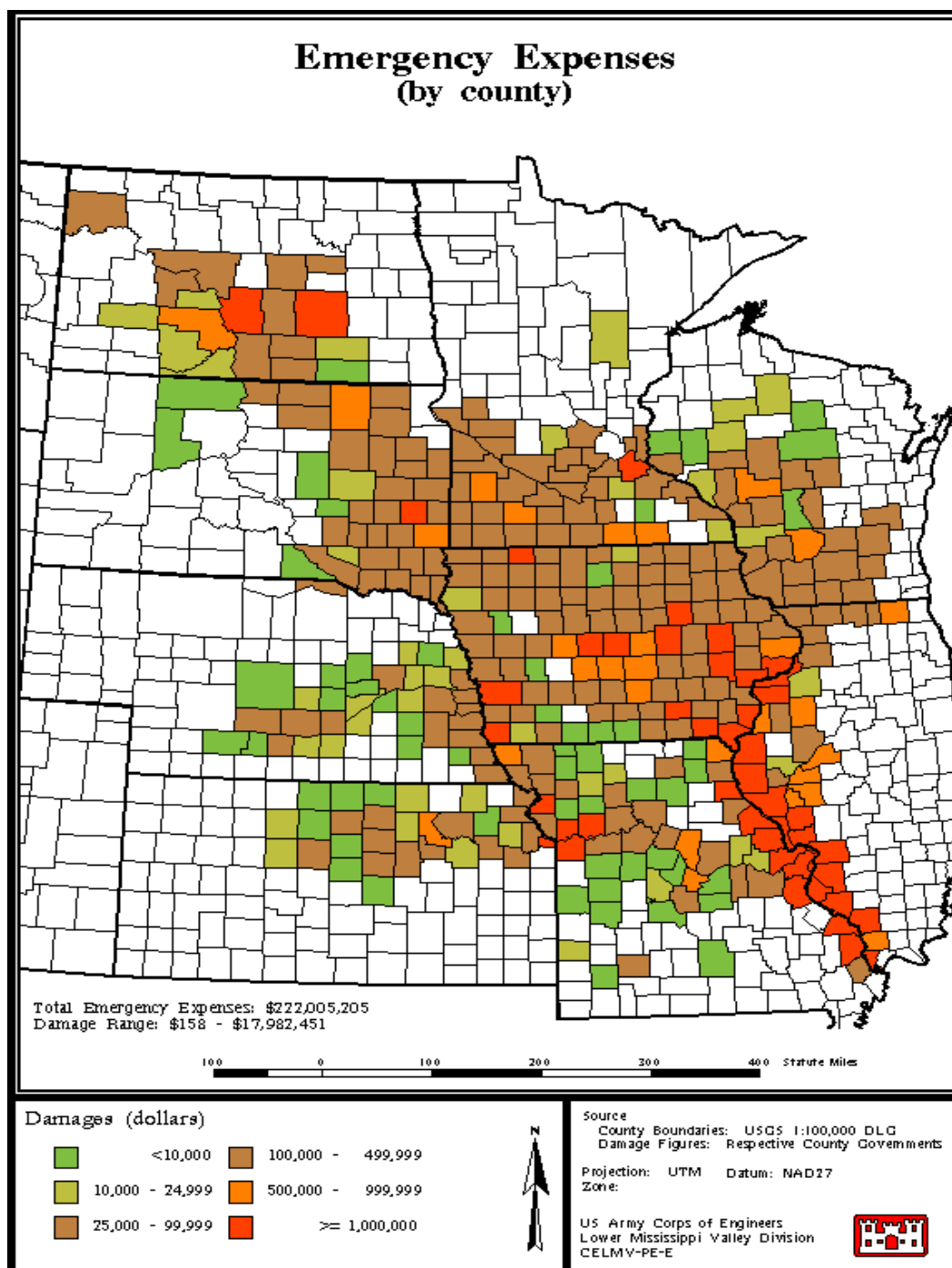


Figure 1. Overview of Area Affected by Great Flood of 1993 and Emergency Response Costs⁷⁴

⁷⁴ From "1993 Flood Damage Maps," <http://el.erdc.usace.army.mil/flood/gifs.html> (accessed 12/8/2008).

C. IMPACT ON IOWA

Iowa was at the geographical center of the 1993 floods. With the Mississippi River serving as its eastern border, the Missouri river its western border, and a network of rivers and streams running throughout the state, the 1993 floods were especially devastating in Iowa. Figure 2 shows Iowa's network of rivers, and Figure 3 provides an overview of the damages caused to residential areas alone. All 99 of Iowa's counties received a presidential disaster declaration. Iowa was the only state of the nine affected by the floods where every county in the state received this level of disaster declaration.

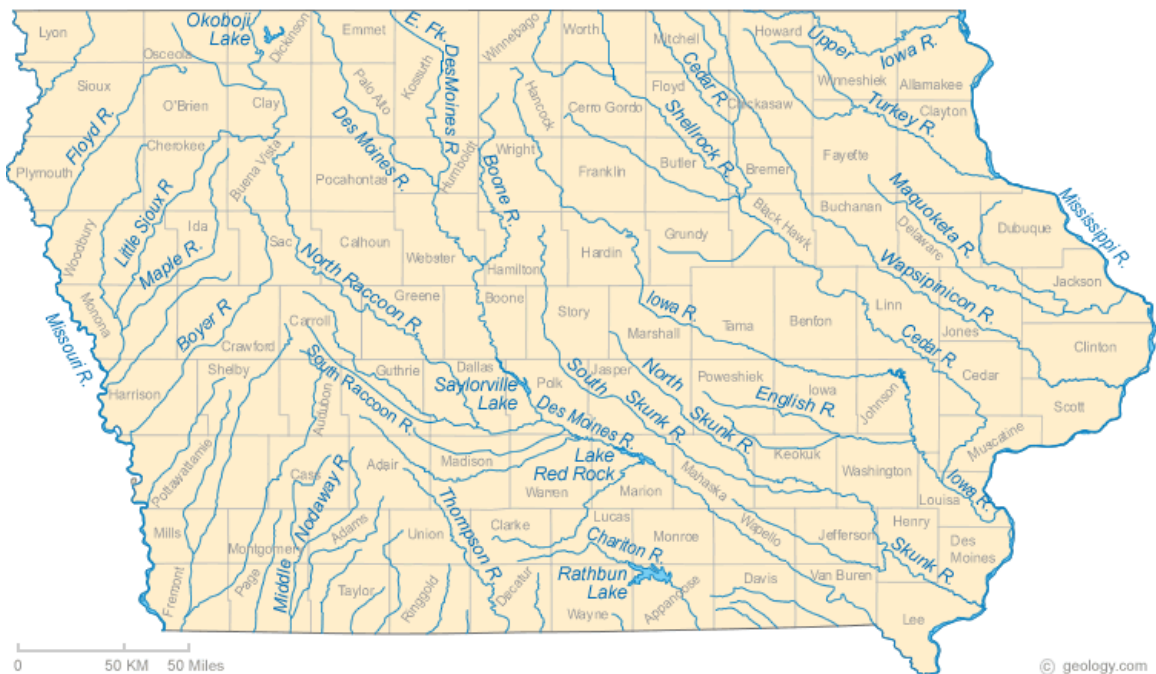


Figure 2. Iowa's Network of Rivers⁷⁵

⁷⁵ From "Iowa State Map Collection," <http://geology.com/state-map/iowa.shtml> (accessed 8/6/2008).

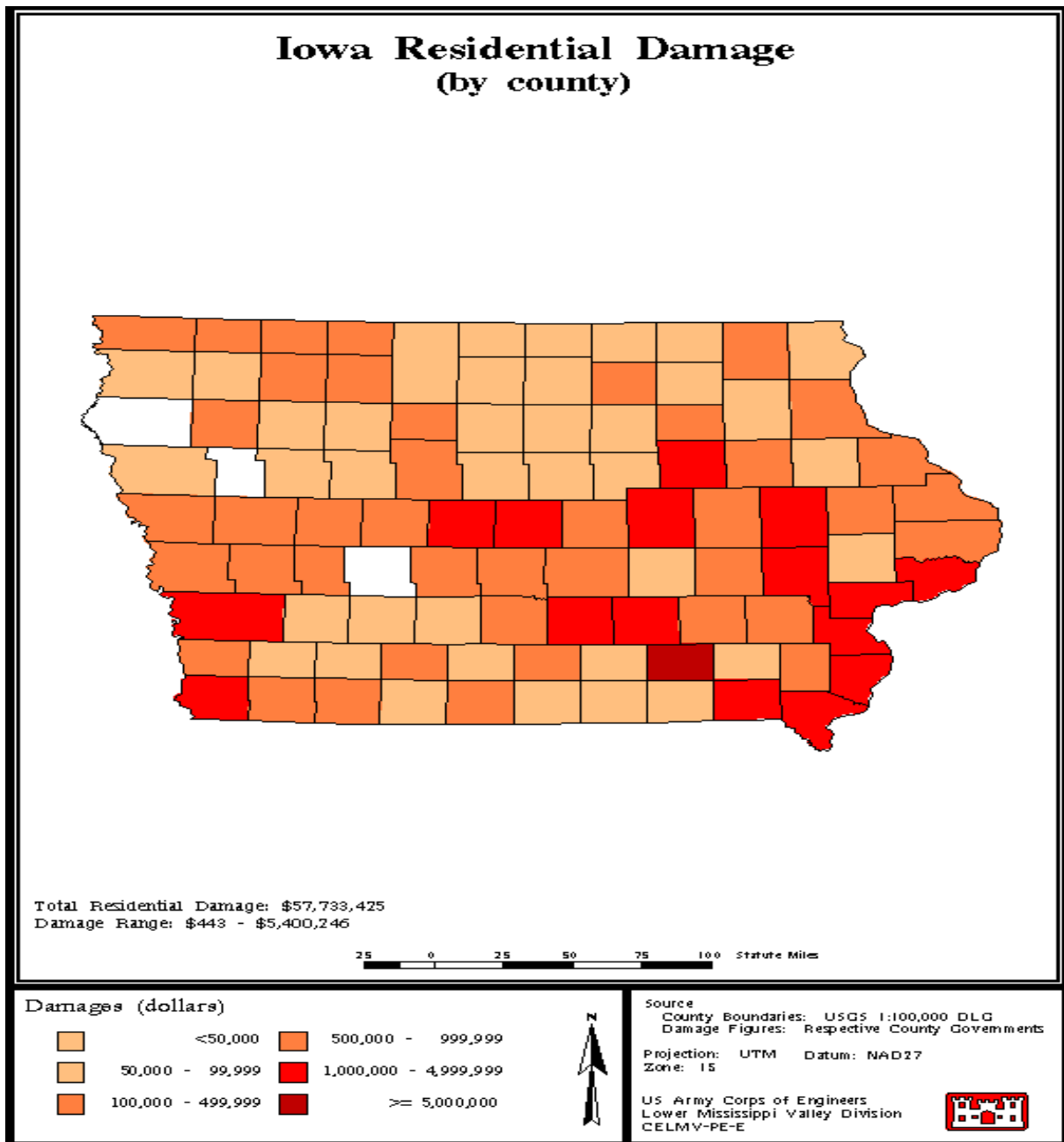


Figure 3. Iowa Residential Damages from Great Flood of 1993⁷⁶

The total damage to property in Iowa from the 1993 floods is estimated at greater than \$1 billion. The damage to Iowa's agriculture was estimated at approximately

⁷⁶ From "1993 Flood Damage Map GIFs," <http://el.erdc.usace.army.mil/flood/gifs.html> (accessed 12/5/2008).

\$1.9 billion, and the total damage, according to state and FEMA estimates, for the state was more than \$3.4 billion.⁷⁷ According to a collection of estimates captured in the Galloway Commission's final report (Figure 4), Iowa suffered the greatest amount of damages from the Great Flood of 1993. In response to the massive damage, Iowa received more than \$1.4 billion in federal aid for response and recovery and the state spent \$0.2 billion.⁷⁸

State	NWS Totals	State Totals	State Agriculture	NY Times Totals	NY Times Agriculture
Illinois	2,640	1,000-2,000	565	1,535	605
Iowa	5,740	>3,400	na	2,200	1,200
Kansas	551	>500	441	574	434
Minnesota	964	1,700	1,500	1,023	800
Missouri	3,430	3,000	1,790	3,000	1,800
Nebraska	295	na	na	347	292
North Dakota	414	600	500	1,500	705
South Dakota	763	596	572	595	595
Wisconsin	904	930	800	909	800
Total	15,701	12,000-13,000	na	11,683	7,231

Figure 4. Damage Estimates of 1993 Midwest Floods in Millions of Dollars⁷⁹

D. AFTERMATH FROM 1993 FLOODS

The Great Flood of 1993 was a national disaster that lasted for several months. The flood captured national attention. According to a survey conducted by the Associated Press, 300 news executives ranked the Flood of 1993 the number one news story in a list of the top five news stories of 1993.⁸⁰ The vast public attention combined with the extent of the damage prompted detailed evaluation of flood mitigation and

⁷⁷ Changnon, 8, and 210–11.

⁷⁸ Galloway, 15; Changnon 8.

⁷⁹ Galloway, 15.

⁸⁰ Changnon, 300.

response efforts at all levels of government. The Executive Office of the President tasked the federal Interagency Floodplain Management Review Committee (IFMRC) to review the causes and consequences of the 1993 floods and the government's existing floodplain management programs. The results and recommendations of the IFMRC along with a congressionally appointed Bipartisan Task Force on Funding Disaster Relief provided analysis and recommendations that led to a philosophical shift in the way the nation addressed floodplain management and flood mitigation. The Flood of 1993 and resulting studies also led to improvements in the National Flood Improvement Program (NFIP) and Federal Crop Insurance Program (FCIP).⁸¹

E. CONCLUSION

This chapter covered the devastation of the Great Midwest Flood of 1993 from an overall perspective and specifically in Iowa to add to the baseline for comparing the 1993 and 2008 floods. The historic floods of 1993 caused massive destruction and hardship in the Midwest. Despite the hardships, the floods had a positive impact. The floods generated national awareness and spawned greater interest in all aspects of floodplain management and flood mitigation that led to improved policies in these areas. In short, the Flood of 1993 provided an impetus for change to all types of flood mitigation efforts at the national, state, and local levels.

⁸¹ Changnon, 261; and Wright (April 2000), 79–83.

IV. THE GREAT MIDWEST FLOOD OF 2008

A. INTRODUCTION

This chapter provides details of the Great Midwest Floods of 2008. The 2008 floods were a significant hydro-meteorological event. Record flood levels reached by several rivers in the upper Mississippi River basin led many local citizens, federal agencies, and national media outlets to draw comparisons between the floods in 2008 and the Great Midwest Floods of 1993. The Floods of 2008 marked the second “500-year flood the Midwest experienced in fifteen years.”⁸²

This chapter provides preliminary background information on the 2008 floods as the final piece of the baseline for comparing the floods of 1993 and 2008. This background information helps determine if federal, state, and local flood mitigation efforts in the fifteen-year period between the floods improved the situation. The chapter is divided into two sections. The first section provides overall details of the 2008 floods. The second section provides the same details specifically associated with Iowa.

B. THE FLOOD

The 2008 Midwest Floods occurred primarily in June of 2008. The floods peaked in late June and continued over the next few of months. Though the extent of the damage inflicted by the 2008 floods is still being tabulated, the data that follows is adequate to estimate damage caused by the 2008 floods. As was the case with the 1993 floods, the 2008 floods hit Iowa the hardest.⁸³

⁸² The term “500-year flood” can be misleading. It implies a 1-in-500 (or a .2 percent) chance a flood will occur in a given year. A more frequently used example is the “100-year flood,” which implies a 1-in-100 (or 1 percent) chance a flood of that magnitude will occur in a given year. Robert Holmes and Heidi Koontz, “Two 500-Year Floods Within 15 Years—What are the Odds?,” http://64.233.167.104/custom?q=cache:rJbJ1LjaI0gJ:www.usgs.gov/newsroom/docs/flooding_in_20080620.pdf+two+500-year+floods&hl=en&ct=clnk&cd=3&gl=us&client=google-coop-np (accessed 8/18/2008).

⁸³ Data on the 2008 floods of the Midwest is still incomplete. Since there is no way to fully account for damages following a flood and no government ‘clearinghouse’ for consolidating damage estimates after a disaster, the information provided is best guess pieced together from numerous news sources and articles on the 2008 floods. “Flood Losses: Compilation of Flood Loss Statistics,” http://www.weather.gov/oh/hic/flood_stats/Flood_loss_time_series.shtml (accessed 12/9/2008).

The 2008 floods claimed the lives of at least 24 people and injured another 148 people. Approximately 40,000 people were forced to evacuate their residences and the flood warnings during the peak of the floods covered more than 325 miles. As of 23 June 2008, 32 levees had been either overtopped or breached. Six of the overtopped levees were federally owned and maintained. The remaining twenty-six were agricultural levees, built to lower standards than federal levees and maintained by non-federal agencies. According to an 8 July report, 41 levees were overtopped or breached with 6 of them maintained by the U.S. Army Corps of Engineers (USACE) on behalf of the federal government.⁸⁴

Similar to 1993, the 2008 floods challenged federal response capabilities. But this time the challenge came on the heels of stark criticism of FEMA and the federal government following a botched response to a major Hurricane (Katrina in 2005). The 2008 floods, however, provided an opportunity to test the changes to national response to a major disaster in the post-Katrina era and allowed Secretary of Homeland Defense Michael Chertoff the opportunity to demonstrate the nation's national response capability was functioning better than during his first year in his position (2005). The floods also offered the new FEMA director, R. David Paulson, appointed in the wake of the government's disappointing response to Hurricane Katrina, a major disaster to demonstrate how FEMA had improved under his leadership. Similar to 1993, the opportunity proved fruitful. The initial public reaction to federal response efforts to the 2008 floods was positive.⁸⁵

⁸⁴ "Latest Midwest Floods Expose Lessons Unlearned." <http://blogs.usatoday.com/oped/2008/07/latest-midwest.html> (accessed 12/16/2008); and Kari Lydersen and William Branigin, "Mississippi River Towns Brace for the Worst; Floodwaters Swell Major Waterway." *The Washington Post*, June 18, 2008, sec. A.

⁸⁵ Michael Chertoff was appointed Secretary of Homeland Security on 15 February 2005. He was not directly criticized for federal response efforts during Hurricane Katrina; however, he was ultimately responsible for FEMA's efforts during Katrina. "Michael Chertoff, Homeland Security Secretary 2005–2009," http://www.dhs.gov/xabout/history/biography_0116.shtm (accessed 9/7/2009). "R. David Paulson Announces Departure," <http://www.fema.gov/news/newsrelease.fema?id=47321> (accessed 11/7/2009); Sheri Fink, "Fed Officials: Response to Midwest Flooding 'Much More Eloquent' than to Katrina" <http://www.propublica.org/article/federal-officials-response-to-midwest-flooding-much-more-eloquent-than-620/> (accessed 8/17/2008); and Keith Schneider, "The Midwest Flooding; In This Emergency, Agency Wins Praise for its Response," <http://query.nytimes.com/gst/fullpage.html?res=9F0CE6DD1531F933A15754C0A965958260> (accessed 8/18/2008, 2008); and "FEMA Earns High Marks for Response to Midwest Flooding." <http://www.foxnews.com/story/0,2933,371085,00.html> (accessed 8/18/2008).

The 2008 floods had a wider national impact beyond the federal government costs for response and recovery. The affected area is a center of corn production. Corn is an important food crop that also serves as an alternative energy source, ethanol. The national focus on alternative energy has, over the past three years, increased the demand for this corn-based energy source and driven up the value and cost of corn. This cost was not as great of a factor in 1993.⁸⁶ After the 2008 flooding, the higher demand for corn, combined with the negative impact of the floods on the supply of corn drove the price of the commodity to record highs. In light of this new demand, the national economic impact of 2008 Midwest Floods has yet to be fully quantified.⁸⁷

Similar to the floods in 1993, the 2008 floods were a result of unique, historical hydro-meteorological conditions. In the month of June alone, more than 1,100 daily precipitation records were broken in the affected region. The majority of the records were broken in Missouri, Wisconsin, Illinois, and Iowa. Fifteen of the record-breaking weather forecasting stations set new all-time records for the most precipitation in a twenty-four hour period.⁸⁸ Figure 5 provides an overview of historical precipitation in the area from October 2007 until mid-June 2008.

⁸⁶ Total corn consumption increased over 50% between 1993 and 2008. In the same period, ethanol production increased over 600% and the average price of corn per bushel increased approximately 60%. "Agricultural Supply and Demand Database," http://www.farmdoc.uiuc.edu/marketing/supply_demand/supply_demanddata.html (accessed 9/7/2009); and "Renewable Fuels Association – Statistics," <http://www.ethanolrfa.org/industry/statistics/> (accessed 9/7/2009).

⁸⁷ Joel Achenbach, "Iowa Flooding Could be an Act of Man, Experts Say," *The Washington Post*, Jun 19, 2008, <http://proquest.umi.com/pqdweb?did=1497097381&Fmt=7&clientId=65345&RQT=309&VName=PQD> (accessed 8/17/2008).

⁸⁸ "Climate of 2008 Midwestern U.S. Flood Overview."

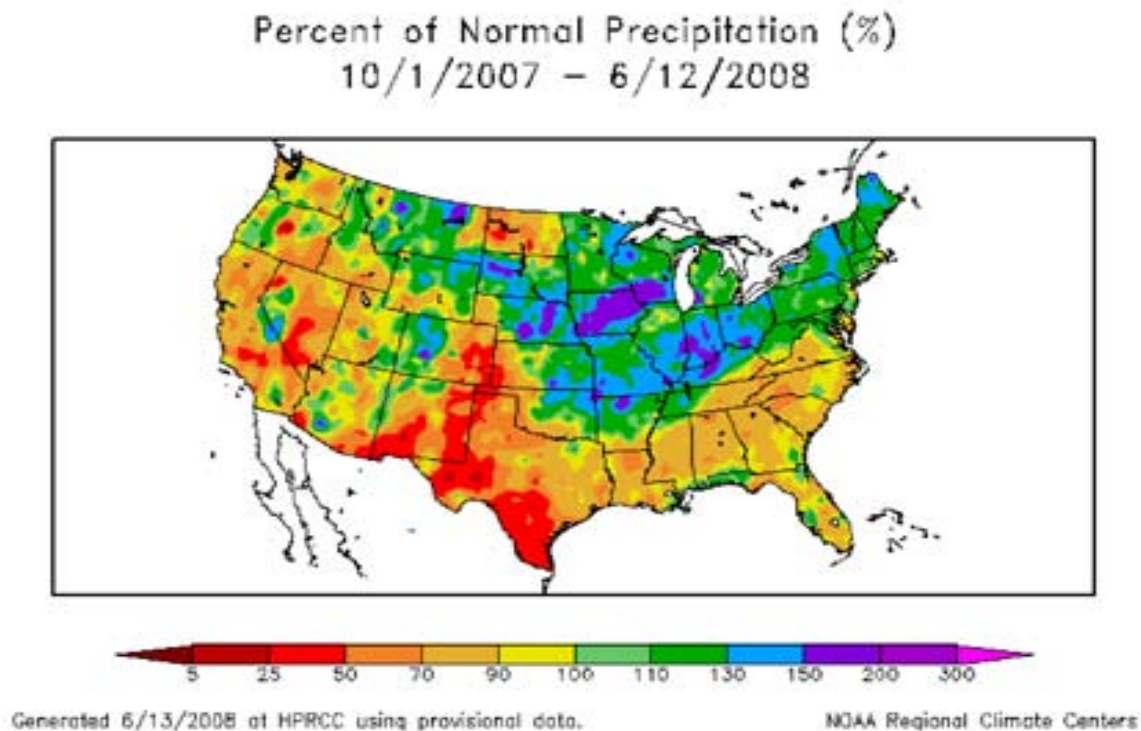


Figure 5. Percent of Normal Precipitation from October 2007 to June 2008⁸⁹

Streamflows from the major tributaries of the region drastically exceeded the flood stage and reached record highs as well. In some locations, the crests exceeded the 500-year flood level. Figure 6 provides a picture of the flood stage according to USGS gauges on 10 June 2008. At the time, 111 gauges in the region exceeded the minor flooding levels; 77 exceeded the moderate flood levels; and 38 gauges exceeded the major flood levels.

⁸⁹ "Percent of Normal Precipitation," <http://www.extension.iastate.edu/NR/rdonlyres/D8593E9B-1789-4814-BCE1-97199FE96B08/80873/Map4WetSpot.jpg> (accessed 12/9/2008).

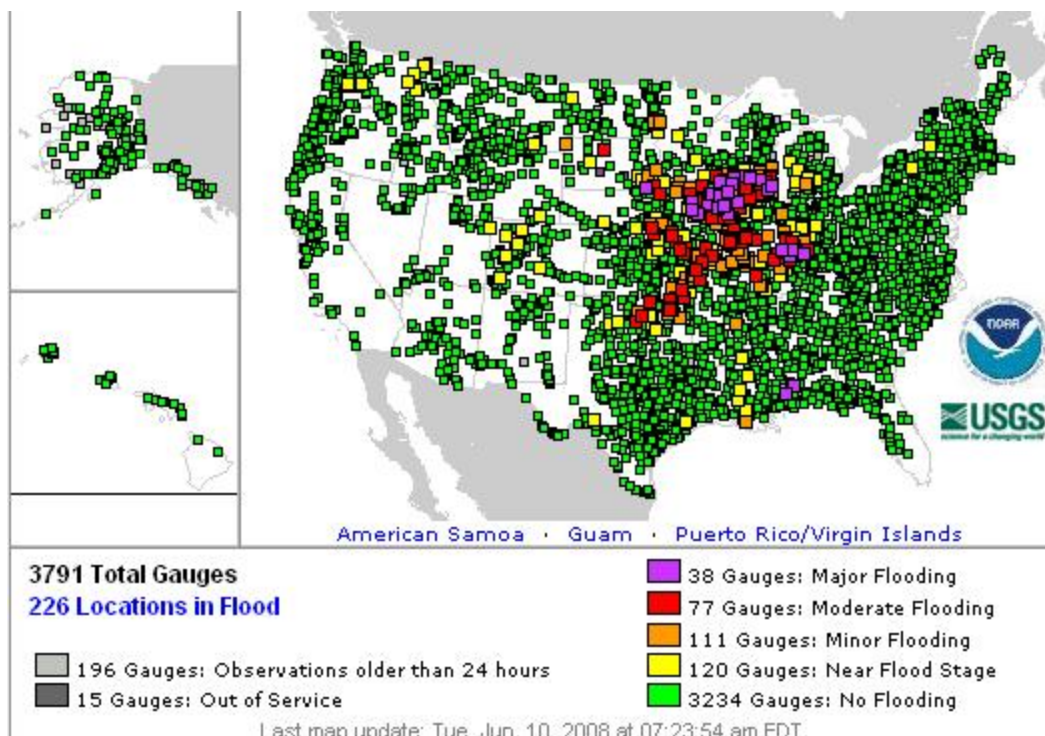


Figure 6. Flood Stage on 10 June 2008⁹⁰

The flood hit the most devastated areas of Iowa on between 11 and 17 June 2008. Figures 7 and 8 provide a snapshot of the flood situation based on high flow conditions on 13 June and 17 June 2008 according to USGS streamflow measurements. The black triangles in the figures represent areas above flood levels and that are forecast to exceed record levels.

⁹⁰ “River Flooding.jpg,” http://en.wikipedia.org/wiki/File:River_Flooding.JPG (accessed (12/9/2008)).

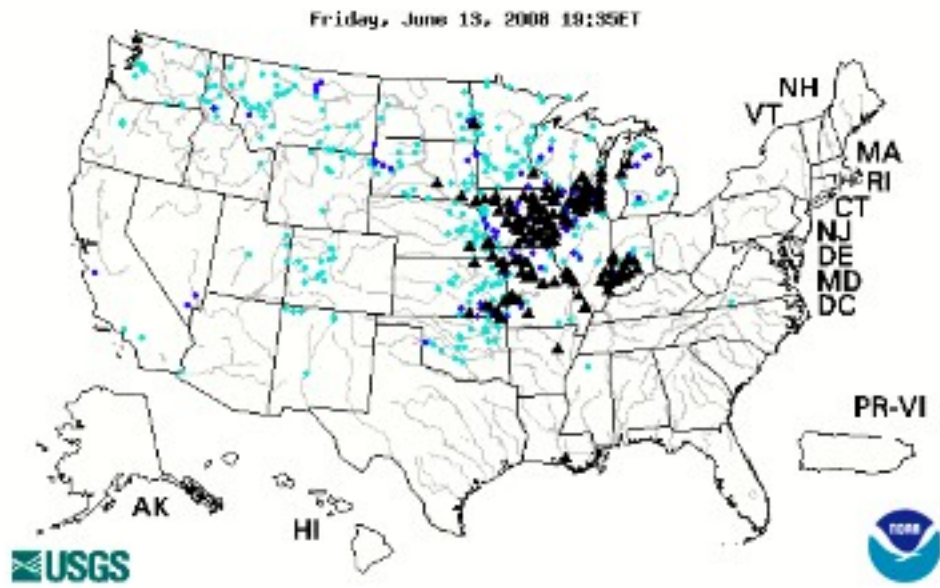


Figure 7. USGS Streamflow gauges on 13 June 2008⁹¹

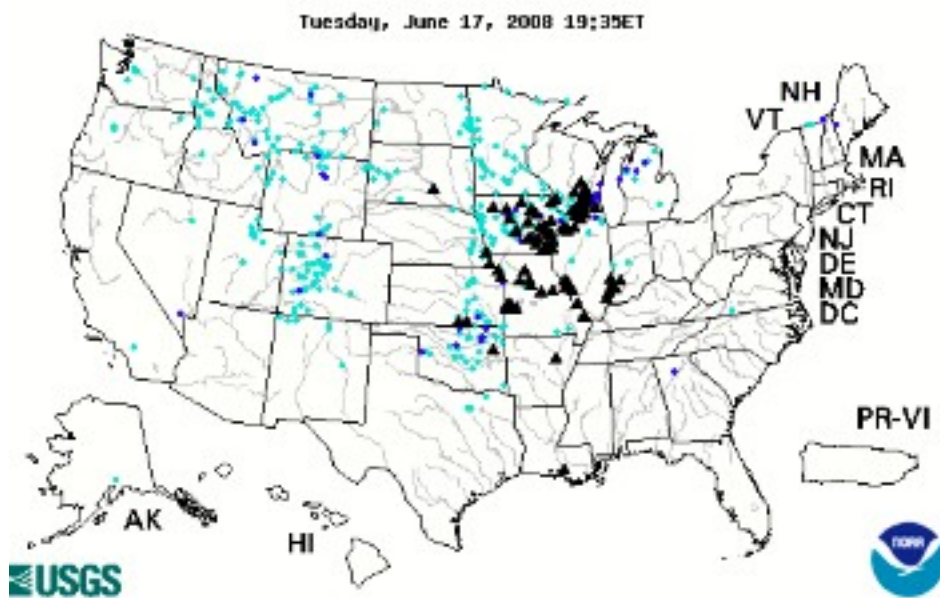


Figure 8. USGS Streamflow gauges on 17 June 2008⁹²

⁹¹ "Archive of Streamflow Maps (United States)," <http://waterwatch.usgs.gov/?m=pamap&r=us&w=flood%2Cgmap> (accessed 11/15/2009).

⁹² Ibid.

To date, estimates of flood damage from the 2008 event are still preliminary. At this point in the recovery, total damages are estimated to range between \$6 billion and \$14 billion. The American Farm Bureau has estimated crop loss damages for the region at \$8 billion. This preliminary estimate is much higher than crop damages for the 1993 floods due, in part, to new demand for alternative energy produced from crops in the affected region. When the floods were at their peak in June of 2008, Congress and the President had already pledged an estimated \$2.7 billion in federal funds to assist in the response and recovery. As of 11 July 2008, 42,080 victims had applied for federal disaster assistance and \$69 million of housing and other disaster assistance had been approved. Since that time more than \$10 billion of federal funds have been earmarked by Congress for Midwest flood relief.⁹³

C. IMPACT ON IOWA

The disasters associated with the floods of 2008 in Iowa began as a result of the extreme weather that prefaced the storm. The official “disaster period” began on 25 May 2008 when numerous tornadoes hit Butler and Black Hawk Counties in Iowa. The disaster officially lasted until all rivers in the state had receded below the flow stage on 13 August 2008.⁹⁴

Iowa was, as in 1993, both the geographic center and the state most affected by the Midwest Floods of 2008. Iowans accounted for over 35,000 of the estimated 40,000 citizens who were evacuated during the 2008 floods. As of 4 December 2008, more than 39,000 Iowa individuals had filed for assistance with FEMA, more than 23,000 households had been approved for \$118.7 million in housing assistance and more than \$240 million in small business assistance from federal agencies. By 4 December 2008, state and federal officials had already approved \$865.7 million in assistance to citizens of

⁹³ “June 2008 Midwest Floods,” http://en.wikipedia.org/wiki/June_2008_Midwest_floods (accessed 12/8/2008); and “Professor Hastak Leading Purdue Researchers to Determine Extent of Flooding in Midwest,” <https://engineering.purdue.edu/CEM/HomepageFeatures/ProfessorHastakLeadingPurdueResearchertoDetermineE> (accessed 12/8/2008). “Assessing the Floods 2008 (and 1993)” Mattoon.

⁹⁴ “Rebuild Iowa Office: Facts and Figures,” http://en.wikipedia.org/wiki/June_2008_Midwest_floods (accessed 12/8/2008).

and businesses in Iowa. With 85 of 99 counties officially declared Presidential disaster areas, the majority of the state was affected by the 2008 floods. The governor of Iowa declared 80 percent of 56,272 square miles of state land, 74 percent of the cities, and 87 percent of the counties in Iowa a disaster area. Figure 9 provides a map of the disaster declarations for the entire Midwest, and Figure 10 shows disaster declarations by county for Iowa.⁹⁵

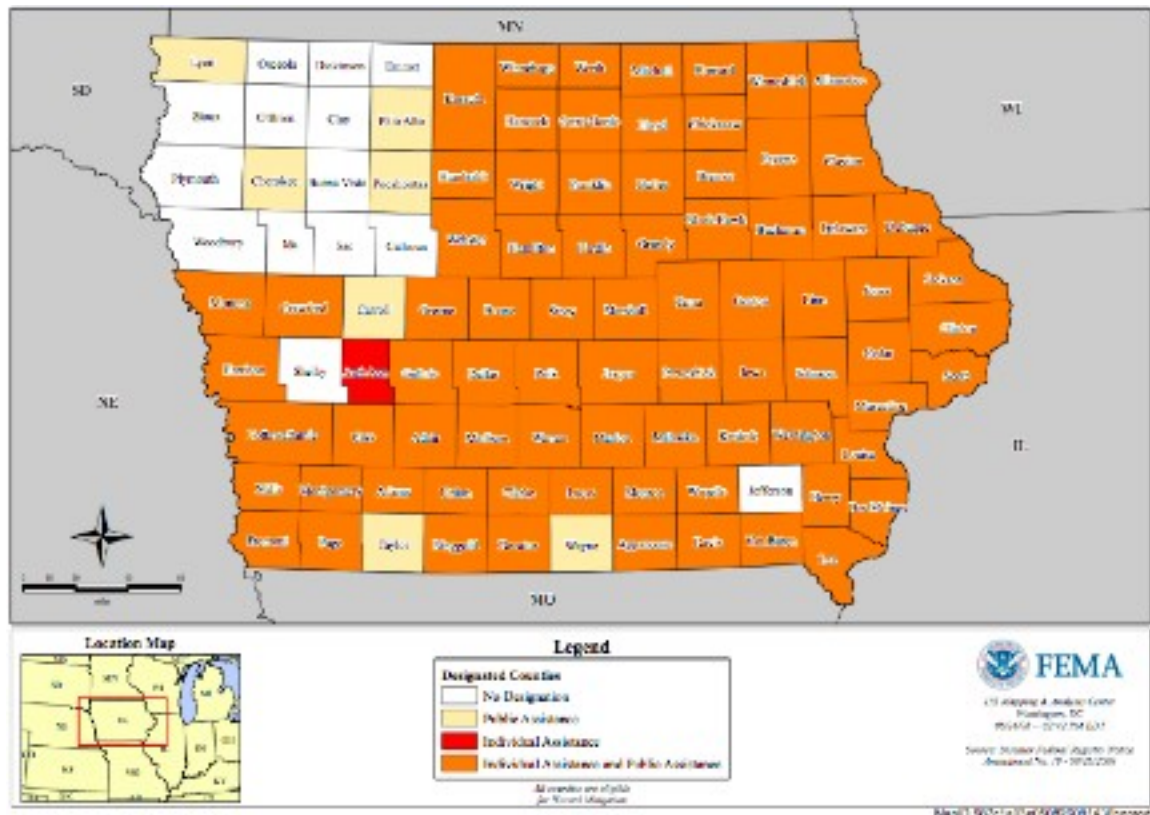


Figure 9. Overview of Disaster Declarations from 2008 Midwest Floods⁹⁶

⁹⁵ “Rebuild Iowa Office: Facts and Figures,” <http://www.rio.iowa.gov/resources/facts.html> (accessed 12/8/2008).

⁹⁶ Randy Schnepf, “Midwest Floods of 2008: Potential Impact on Agriculture,” CRS Report RL34583 (U.S. Congressional Research Service: July 16, 2008), 3.

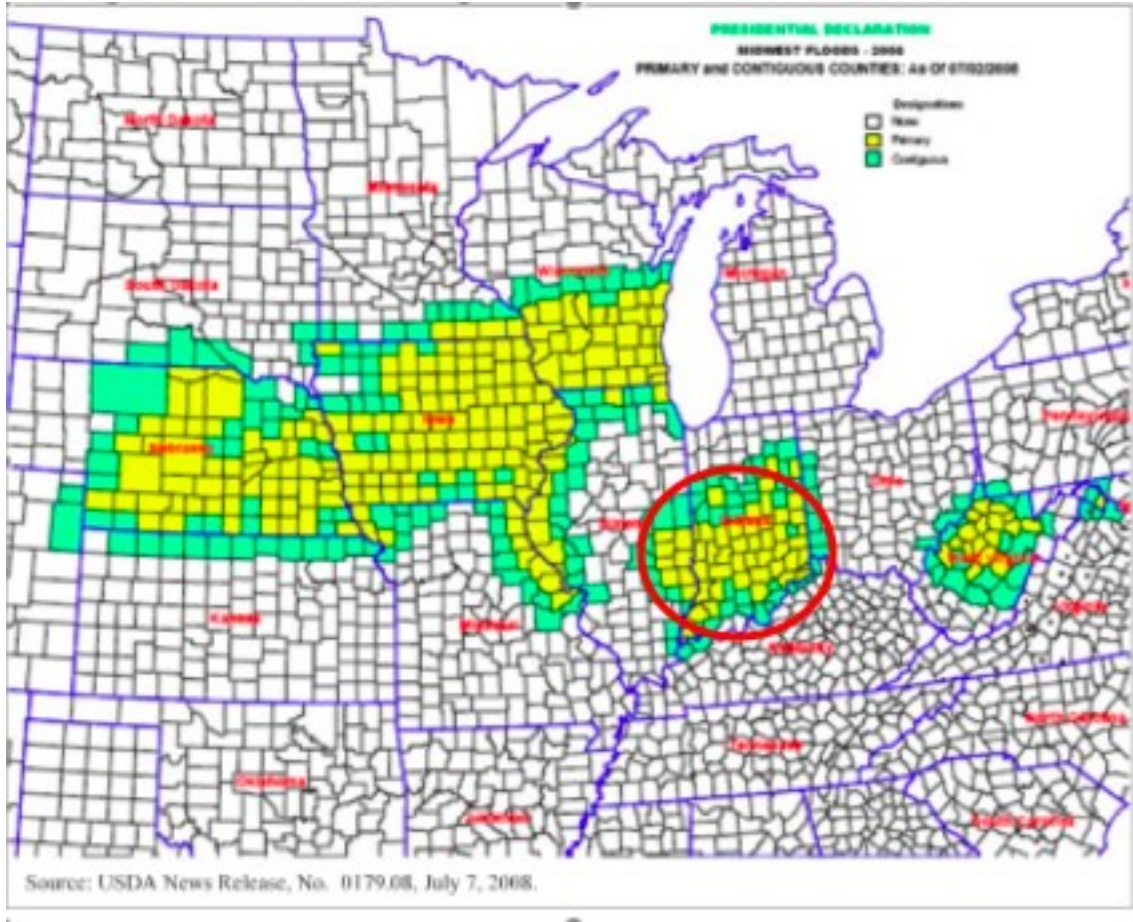


Figure 10. Iowa Disaster Declarations as of 26 August 2008⁹⁷

The 2008 floods in Iowa were a result of record precipitation. In June of 2008, a 25-day wet period record was set. The National Weather Service recorded record flooding at 12 locations on four rivers in Iowa. The USGS's stream gauges recorded 500-year level flooding on three rivers in Iowa. On the 9th of June, 55 USGS stream gauges were already above the flood stage. By the time the damage was done, a total of nine Iowa Rivers crested at or above record levels.⁹⁸

⁹⁷ "FEMA 1763-DR, Iowa Disaster Declarations as of August 26, 2008," http://www.gismaps.fema.gov/2008graphics/dr1763/dec_1763.pdf (accessed 11/15/2009).

⁹⁸ "Facts and Figures"; "USGS Crews Measure Record Floods in Iowa"; "Iowa Flooding Could be an Act of Man, Experts Say"; and "Iowa—Midwest Flood News and Statistics."

The 2008 floods destroyed 1.3 million acres of corn and two million acres of soybeans, which accounted for more than twenty percent of Iowa's total grain crop. This damage alone is an economic loss estimated to exceed \$2 billion. The American Farm Bureau estimated Iowa's total crop losses at \$4 billion, which is half of the total estimated agricultural loss (of \$8 billion) for the entire region. As the largest national producer of corn, the damages from the 2008 floods were more costly to crops in Iowa than in 1993 due in part to the increased demand for alternative energy sources ⁹⁹

D. CONCLUSION

This chapter provided details of the Great Midwest Flood of 2008 and its impact to the Midwest and specifically in Iowa. Though preliminary, the damage estimates from the 2008 floods were near the same overall level for the 1993 floods, and the damage estimates for Iowa in 2008 exceeded the levels recorded in 1993.. While the floods did not impact as wide a geographic area as the 1993 floods, the floods caused heavy damage in the areas affected by them. Of the Midwestern states, Iowa was affected the most by the 2008 floods and suffered the most damages as a result of the floods. The similarities between the two floods, especially with respect to Iowa, validate their selection for the comparative analysis portion of this thesis. This chapter is the final component in the baseline information required to complete the comparative analysis conducted in the next chapter.

⁹⁹ Rick Mattoon, "Midwest Economy: Assessing the Midwest Floods of 2008 (and 1993)," http://midwest.chicagofedblogs.org/archives/2008/07/mattoon_flood_b.html (accessed 8/3/2008); "U.S. Midwest Floods Choke Rail, Barge, Road Traffic - Cattle Network," <http://www.cattlenetwork.com/Content.asp?ContentID=229291> (accessed 8/19/2008); Dennis Coday and Rich Heffern, "Midwest Floods," *National Catholic Reporter* 44, no. 23 (7/11/2008): 5-7; Michael Judge, "After the Flood," *Wall Street Journal* (June 17, 2008): A.21; "Iowa - Midwest Flood News & Statistics | MCEER Information Service," <http://mceer.buffalo.edu/infoservice/disasters/iowa-flood-news-statistics.asp> (accessed 8/3/2008).

V. ANALYSIS: COMPARING THE GREAT MIDWEST FLOODS OF 1993 TO THE GREAT MIDWEST FLOODS OF 2008

A. INTRODUCTION

The 1993 and 2008 floods centered upon the Upper Mississippi River Basin. The following chapter highlights similarities and differences of the two floods to the overall region and specifically in Iowa. The chapter conducts a comparative analysis of Iowa's Black Hawk County. The analysis focuses on the county's most populous area, the twin cities area of Waterloo and Cedar Falls. The purpose of the micro-level analysis is to identify and determine the effectiveness of the local flood mitigation efforts between the floods and captures disaster response efforts during the 2008 floods. The local-level analysis incorporates the impact of federal disaster response and flood mitigation changes during the period. The analysis in this chapter goes directly to the two core questions of this thesis: Have the changes to national disaster response and the investments in flood mitigation since the Great Flood of 1993 worked? In light of recent record flooding in the Midwest, did prior mitigation efforts reduce damage to personnel and property and has emergency response to flooding improved?

B. IMPACT OF 2008 FLOODS COMPARED TO 1993 FLOODS

The 1993 floods impacted nine states throughout the Midwest. Fifteen years later, record floods occurred in the same region. However, the overall area affected by the 2008 floods is less than the 1993 floods. The 2008 floods affected seven states, and five states were severely impacted. Nine states were impacted during the 1993 floods. Figure 11 provides a snapshot comparison of the spatial impact of the overall floods.

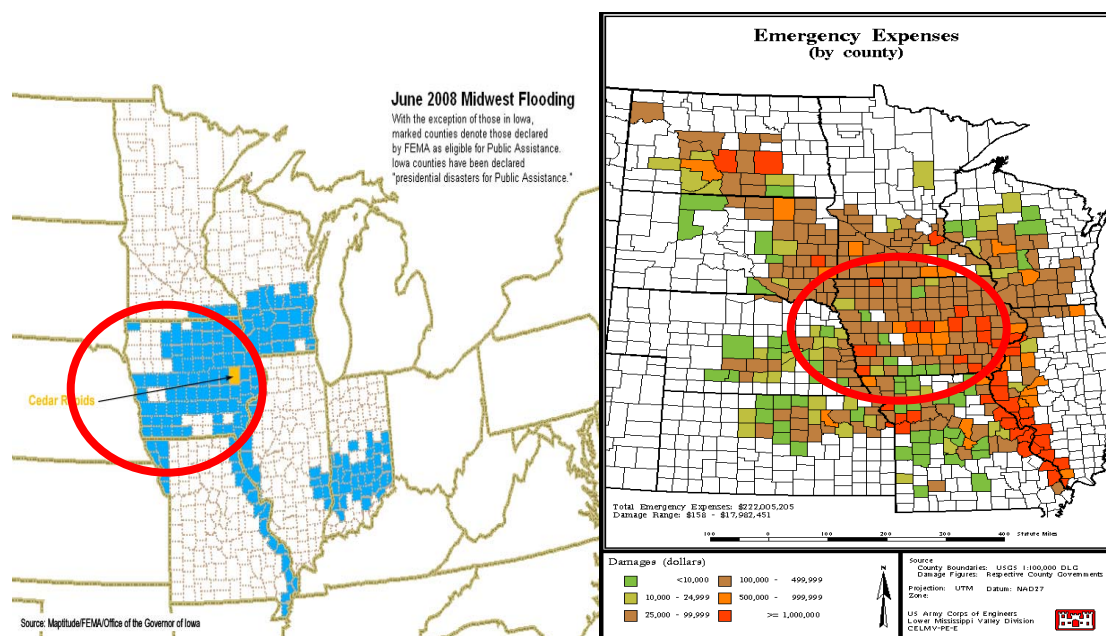


Figure 11. Overall Spatial Comparison of 1993 and 2008 Great Midwest Floods

The 1993 floods produced record flood observations at 95 forecasting points monitored by the National Weather Service (NWS), and observations above the flood stage at 500 NWS flood forecasting points. Streamflows from the major tributaries of the region drastically exceeded the flood stage and reached record highs in 2008 as well. In some locations, the crests during the 2008 event exceeded the 500-year flood level. In 2008, NWS flood forecast points recorded 226 observations above the flood stage. Record flood observations were recorded at 12 locations in Iowa alone during the 2008 event.¹⁰⁰

The overall impact to the region was less severe in 2008 than 1993 for reasons beyond simply the geographic extent of the flooding. The number of levee breaches in 1993, more than 1,000, was significantly higher than 41 levee failures experienced in 2008. The lower number of breaches in 2008 was important because it decreased the overall amount of flooding in spite of record setting precipitation in the six months prior

¹⁰⁰ "The Great Flood of 1993," <http://mo.water.usgs.gov/Reports/1993-Flood/index.htm> (accessed 23 November 2008); Gallaway, 8–9; USGS Report "Great Flood of 1993—10- years later"; "Facts and Figures"; "USGS Crews Measure Record Floods in Iowa"; and "Iowa—Midwest Flood News and Statistics."

to the floods in 2008. More than 100 weather stations in the Midwest met or exceeded previous precipitation records in the first six months of 2008. In comparison, only 33 percent of the weather stations exceeded record levels in the first six months of 1993. The lower number of breeches in 2008 suggests structural improvements since the 1993 floods have improved. However, the precipitation in the regions in the fall prior to the respective years of flooding also contributed to the difference. Over the fall of 1992 precipitation amounts were 125 to 150 percent above normal, while the same region received far less, only 50 to 75 percent of normal rainfall in the fall of 2007.¹⁰¹

Agricultural losses in 2008 were greater due to the combined effect of record corn prices and the nation's largest corn producer (Iowa) taking the most damage.¹⁰² Additionally, the loss estimates from the 2008 floods are still preliminary, and the full extent of loss cannot be calculated until further in the recovery phase of this disaster. Despite the preliminary nature of the information for the 2008 floods, the similarity in the size of the events and impact to the region enable the comparison conducted throughout this chapter. Table 1 provides an overview comparison of the two floods. Table 2 provides a specific comparison of the impact of the floods on corn production yield in 1993 and 2008.

¹⁰¹ "Climate of 2008 Midwestern U.S. Flood Overview," "Disastrous Floods a Part of Midwest History," and "Latest Midwest Floods Expose Lessons Unlearned."

¹⁰² Corn cost \$2.07/bushel in 1993 and \$4.20/bushel in 2008. "U.S. Corn Variables (1975/76–2007/08)," <http://www.farmdoc.uiuc.edu> (accessed 9/24/2009).

Table 1. Comparison of Greats Floods of 1993 and 2008¹⁰³

Conditions	1993 Floods (Estimates)	2008 Floods (preliminary estimates)
Area Flood (millions of acres)	20.1	> 5.0
Property Damage (billions of dollars)	12.7	6.0
Number of Deaths	52	24
Buildings Damaged	70,000	40,000
Agriculture Losses (billions of dollars)	7 (10.6)*	8
Number of People Made Homeless	89,000	42,000**
Duration of Floods	3 months	3 months

*(2008 dollar amount equivalents in parenthesis)¹⁰⁴

¹⁰³ 42,000 homeless in 2008 comes from the number of applications for assistance. “June 2008 Midwest Floods,” http://en.wikipedia.org/wiki/June_2008_Midwest_floods (accessed 12/8/2008); and “Professor Hastak Leading Purdue Researchers to Determine Extent of Flooding in Midwest,” <https://engineering.purdue.edu/CEM/HomepageFeatures/ProfessorHastakLeadingPurdueResearcherstoDetermineE> (accessed 8 December 2008). “Assessing the Floods 2008 (and 1993)” Mattoon.; “Midwest Floodwaters Falling, Costs Rising,” <http://rtf.wordpress.com/2008/07/02/the-cost-of-midwest-flooding-rises/> (accessed 12/12/2008); “Midwest Floods.” http://www.catdesk.com/ClientResources/Catupdates/CatUpdatePublic.asp?event_id=2582 (accessed 12/14/2008); and Changnon, 253.

¹⁰⁴ Inflation rate from 1993 to 2008 is 51.53%. “How Much would it Cost Calculator.” http://inflationdata.com/inflation/Inflation_Calculators/HowMuchWoulditcostCalculator.asp (accessed 12/14/2008).

Table 2. Comparison of Impact of the Floods on Corn Yield in 1993 and 2008¹⁰⁵

Marketing Year	Planted Acreage (million)	Harvested Acreage (million)	Yield per Acre (bushels)
1992	79.311	72.077	131.5
1993	73.239	62.921	100.7
1994	78.921	72.887	138.6
2007	93.600	86.542	151.1
2008	85.985	78.640	153.9
2009	Not Available	80.007	161.9

C. IMPACT OF THE TWO FLOODS IN IOWA

While on a regional basis, the 2008 flood was, overall, less severe than the 1993 floods, the 2008 floods were more severe in Iowa. Iowa accounted for 55 of the 226 USGS gauges that exceeded the flood stage. Three rivers produced readings higher than the 500-year flood stage, and nine rivers in Iowa posted record flood levels. The Cedar River delivered the hardest blows to Iowa by exceeding record levels at the two most populous areas, Waterloo-Cedar Falls area and Cedar Rapids, along its course. Table 2 shows the record and the top five flooding levels of the Cedar River at Cedar Falls, Waterloo, and Cedar Rapids. Table 3 provides a comparison of the damages in Iowa from the 1993 and 2008 floods.¹⁰⁶

¹⁰⁵ The Acres planted decreased in the year of both floods. However, the difference in the amount harvested compared to amount planted each year was not much different from previous years, and in 2008, the difference between amount planted versus amount harvested was less than the previous year. The bottom line is that the amount of corn available during the flood years was much less than previous years despite 2008 producing a near-record yield. "Corn and Soybeans: Harvested Acreage and Yield Per Acre," <http://www.econ.iastate.edu/outreach/agriculture/periodicals/chartbook/Chartbook2/Tables/Table10.pdf> (accessed 11/15/2009); "Corn Production Trends," <http://www.ncga.com/corn-production-trends> (accessed 11/15/2009); and Roger Elmore and Lori Abendroth, Is All Well That Ends Well? Iowa Corn—2008 <http://www.extension.iastate.edu/CropNews/2008/1208elmoreabendroth.htm> (accessed 11/14/2009).

¹⁰⁶ USGS "55 gauges Reference" "Black Hawk County Online," <http://www.co.black-hawk.ia.us/about.html> (accessed 8/28/2008, 2008); "Linn County," http://www.co.linn.ia.us/content.asp?Page_Id=230 (accessed 8/28/2008, 2008).

Table 3. Historic Crests and Flood Stages of the Cedar River¹⁰⁷

Historical Crests	Cedar Falls	Waterloo
2008	102.13 ft (6/11/2008)	25.39 ft (6/11/2008)
1993	95.80 ft (4/2/1993)	20.60 ft (6/2/1993)
Initial Flood Stage	88 ft	12 ft
Moderate Flood Stage	90 ft	15 ft
Major Flood Stage	93 ft	19 ft

* 2008 crests set new record highs for the Cedar River in both locations.

Table 4. Damage Comparison of 1993 and 2008 Floods in Iowa¹⁰⁸

	1993	2008
Disaster Declarations (number of counties)	99 of 99	85 of 99
Estimated Property Damage (billions of dollars)	1.0 (1.5)*	>1.5
Estimated Crop Losses (billions of dollars)	1.9 (2.8)*	4.0
Estimated Total Damage (billions of dollars)	3.4 (5.1)*	>5.0

* Costs in 2008 dollars indicated in parenthesis.

¹⁰⁷ “Cedar River at Waterloo,” [http://www.crh.noaa.gov/ahps2/river.php?wfo=dvn&wfoid=18758&riverid=204611&view=1%2C1%2C1%2C1%2C1%2C1%2C1%2C1&toggles=10%2C7%2C8%2C2%2C9%2C15%2C6&pt\[\]=141904&pt\[\]=142137&allpoints=142639%2C143542%2C143419%2C146662%2C144297%2C141904%2C142137%2C145364%2C146832%2C144869%2C142045&data\[\]=all&submit=Make+my+River+Page!](http://www.crh.noaa.gov/ahps2/river.php?wfo=dvn&wfoid=18758&riverid=204611&view=1%2C1%2C1%2C1%2C1%2C1%2C1%2C1&toggles=10%2C7%2C8%2C2%2C9%2C15%2C6&pt[]=141904&pt[]=142137&allpoints=142639%2C143542%2C143419%2C146662%2C144297%2C141904%2C142137%2C145364%2C146832%2C144869%2C142045&data[]=all&submit=Make+my+River+Page!) (accessed 11/6/2008).

¹⁰⁸ Inflation rate from 1993 to 2008 is 51.53%. “How Much would it Cost Calculator.” [http://inflationdata.com/inflation/Inflation_Calculators/HowMuchWould it costCalculator.asp](http://inflationdata.com/inflation/Inflation_Calculators/HowMuchWould%20it%20costCalculator.asp) (accessed 12/14/2008).

Overall, the 2008 floods were not as devastating to the Midwest as the 1993 floods. However, Iowa suffered major damage from the 2008 floods with preliminary estimates equal to or greater than the damage suffered by the state in 1993. Despite the historic floods and enormous damages suffered, there is evidence state and local efforts to prepare, prevent, and respond to damages from severe flooding have improved in the last fifteen years. The next section analyzes the flood mitigation efforts in Black Hawk County, Iowa during the last fifteen years to determine their effectiveness in minimizing flood damage during the historic floods of 2008.

D. BLACK HAWK COUNTY AND THE 2008 FLOODS

1. Overview

Black Hawk County is located on the Cedar River in Northeastern Iowa. The county's population centers are Waterloo and Cedar Falls, which are adjacent communities located along the Cedar River. According to 2006 U.S. Census Bureau estimates, the Waterloo-Cedar Falls metro area accounts for 82 percent of the county's population (102,938 of 126,106). The John Deere manufacturing site in Waterloo produces agriculture equipment and is the largest employer in the county. Black Hawk County is Iowa's fourth largest county in terms of population.¹⁰⁹

Comparing U.S. Census data from 1990 to 2006, the population of Black Hawk County has grown by approximately two percent. Based on the small differences in the data, the assumption is the population of the county is relatively the same for 2008 as in 1993.

Black Hawk County has taken an aggressive approach to all phases of flood mitigation: protection, prevention, response, and recovery. The next two sections detail specific actions taken by the county since 1993 to determine if their efforts were worth the costs. The first section examines structural and non-structural mitigation efforts

¹⁰⁹ "Black Hawk County Online," <http://www.co.black-hawk.ia.us/about.html> (accessed 8/28/2008); "State and County Quick Facts: Iowa," <http://quickfacts.census.gov/qfd/states/19000.html> (accessed 12/8/2008). "Waterloo-Cedar Falls, Iowa Community Fact Sheet," www.cedarvalleyalliance.com (accessed 12/8/2008).

undertaken by Black Hawk County and the impact of these actions in light of the record flooding of 2008. The second section details specific actions taken within the county to comply with federal guidelines associated with the National Response Framework (NRF) and National Incident Management System (NIMS) prior to the 2008 floods. The section also analyzes integration of local, county, state, and national agencies based on response and recovery during the record floods of 2008.

2. Mitigation Efforts Since 1993

The impact of the 1993 floods devastated much of the Midwest. As a result of the damages suffered in Black Hawk County and the Waterloo-Cedar Falls metro area, the city and county planners followed the recommendations of the Galloway Commission and took a new, comprehensive approach following the 1993 floods. The new approach included both structural and non-structural mitigation efforts to reduce the impact of future floods on the area.

a. Structural Mitigation Efforts

Structural flood protections in the Waterloo-Cedar Falls area were built by the U.S. Army Corps of Engineers (USACE) under a cost-share between the federal government, state, and local governments. Prior to the 1993 floods, the cost-share for major projects was 75 percent funded by the federal government and 25 percent funded by state and/or local governments. The Waterloo structural flood protection system, consisting of levees, floodwalls, and pumps, was constructed in the late 1970s and early 1980s. Cost data to include the federal-state share percentages is not readily available. However, according to Kirk Sunderman, the Waterloo Flood Area Engineer with USACE, the levee system performed according to design during the 1993 and 2008 floods. FEMA floodplain maps for the Waterloo area show the levee system is designed to protect against a .2 percent chance of a flood in any given year, or the 500-year flood level. Figure 12 provides the FEMA floodplain map of the majority of Waterloo, Iowa.

The light grey areas represent Zone B floodplains, which are the areas protected by the levee system in Waterloo. Flood insurance is not required in Zone B floodplains protected to this level.¹¹⁰

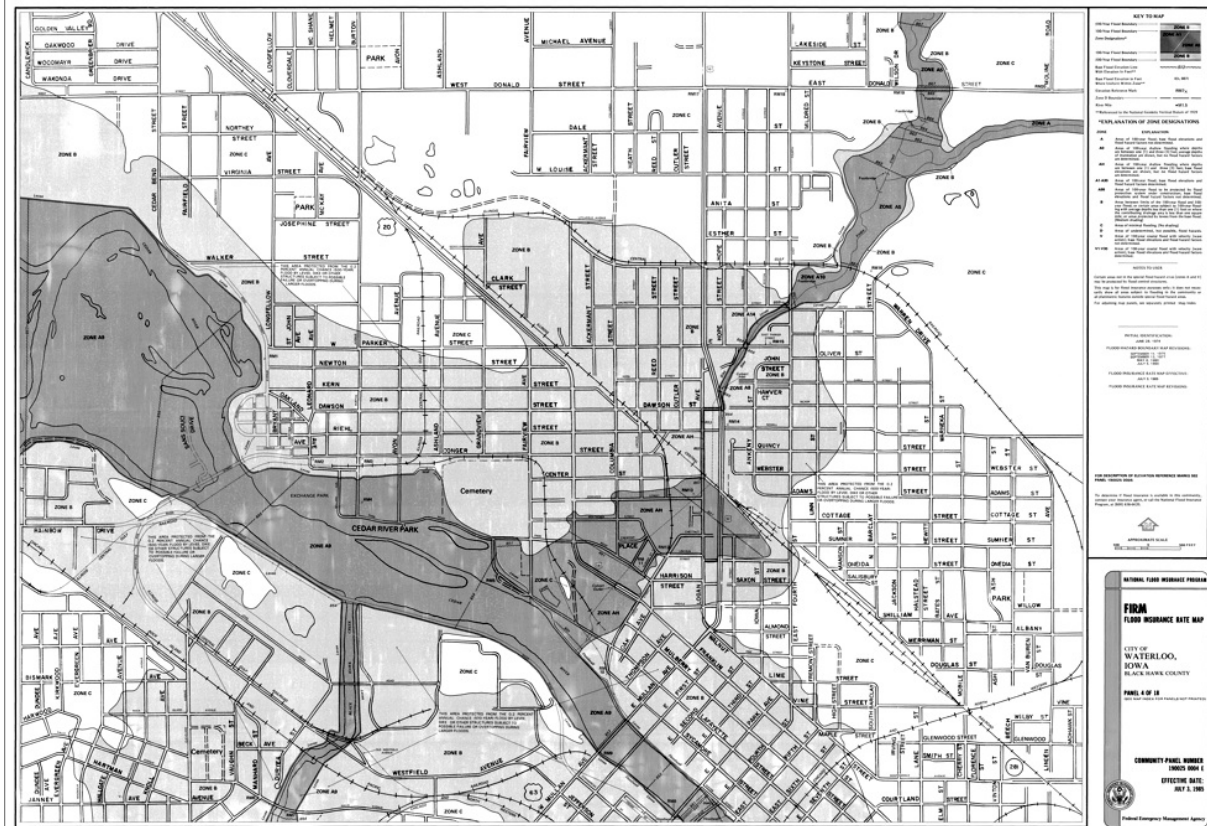


Figure 12. FEMA Flood Insurance Rate Map for Waterloo, Iowa (Panel 4 of 18)

Despite efforts by local officials pushing for a structural protection system beginning in the 1980s, Cedar Falls did not have an effective levee system in place prior to the 1993 floods. USACE first conducted a feasibility study of a structural flood protection system in 1984. A follow-up study by USACE, initially completed in July 1991 and revised in February 1992, concluded a flood protection system did not meet cost-benefit criteria required for USACE to consider any of options to provide 100-year

¹¹⁰ Personal communication with author and Kirk Sunderman, 11/7/2008; “FEMA, Frequently Asked Questions: What are the different flood hazard zone designations and what do they mean?” http://www.fema.gov/plan/prevent/fhm/fq_gen13.shtm (accessed 12/15/2008).

(or 1 percent) protection for any of the three areas of Cedar Falls. According to the survey, none of the options were either economically feasible or a “National interest.”¹¹¹

The perspective on a flood protection system changed after the 1993 floods. Under a cost-share system between the federal government, the state of Iowa, and local governments, a flood protection system was designed and implemented to protect the business area of downtown Cedar Falls. The \$5 million project was credited for protecting \$5.8 million dollars of property from floods in the year it was completed, 1999.¹¹²

The flood protection project was in place when the record floods of 2008 hit. The levee was designed to protect the downtown area of Cedar Falls from a 250-year flood (1 in 250, or .6 percent, chance of flooding each year). This standard upheld and protected the city in all floods since it was completed in 1999. However, as flood forecasts for the Cedar River in 2008 began to exceed its highest crests since 1999, engineers, city planners, and citizens grew concerned. The forecast 24 hours before the river crested on June 11, 2008 was for the Cedar River to crest at 103 feet, a full 15 feet above the initial flood stage and nearly 7 feet higher than the previous record. The forecast charged an estimated 3,000 volunteers into action. The team moved 5,100 tons of sand to create 6,100 feet of sandbag reinforcement for the levee. The structural integrity of the levees and hasty reinforcements led to a successful fight to protect downtown Cedar Falls from devastating floods from the record crest of 102.13 feet achieved by the Cedar River on 11 June 2008.¹¹³ According to Barb Hugi, a city planner for Cedar Falls, “Without the levee, [the] downtown area would have been inundated in

¹¹¹ “Cedar Falls Loves New Floodwall,” <http://www.highbeam.com/doc/1P2-17233335.html> (accessed 12/16/2008); and Patricia Risser, “Final Reconnaissance Report on Cedar River and Tributaries; Black Hawk County, Iowa,” (Rock Island, IL: U.S. Army Corps of Engineers, 14 Feb 1992.),22–25.

¹¹² “Love the Flood Wall,” http://www.agc.org/cs/local_flood_protection (accessed 12/15/2008).

¹¹³ Jon Erickson, “Help or High Water: The Effort to Save the Cedar Falls Levee Was Never a Sure Thing,” *Waterloo Cedar Falls Courier* 22 June 2008 http://wcfcourier.com/news/metro/article_c6ee4101-eb18-5f43-82af-710994e09411.html (accessed 12/12/2008); Jon Erickson “North Cedar Residents: City’s Effort Fell Short,” http://editorialmatters.lee.net/articles/2009/11/13/stories/top_stories/9unews099.txt (accessed 11/15/2008); and “Advanced Hydrologic Prediction Service: Cedar River at Cedar Falls.” <http://water.weather.gov/ahps2/hydrograph.php?wfo=dmx&gage=cedi4&view=1,1,1,1,1,1,1> (accessed 12/8/2008).

this year's flood event."¹¹⁴ Following the 2008 floods, the \$5 million flood protection project can now be credited with protecting an estimated \$11.6 million in total property damage.¹¹⁵

While the USACE-built levee performed as designed and protected the downtown area of Cedar Falls with help from a large contingent of volunteers, the results in other parts of Cedar Falls in 2008 were not as good. Residents of North Cedar, not protected by the flood protection system built in 1999, felt the brunt of the record flood. In another area not protected by the flood protection system, the floods deluged the main office and power production facilities of Cedar Falls Utilities (CFU) in 2008. A recently installed, privately funded protection system of concrete walls and water-filled bladders designed to protect CFU from a major flood failed. Fortunately, CFU had plans in place that would provide the citizens of Cedar Falls power via alternate routes and power generation sources in Western Iowa. The plans that were put in place in the 1970s worked as designed and power was not lost in the city despite the main campus of CFU taking more than 6 feet of floodwaters.¹¹⁶

In short, the federally funded and constructed structural mitigation efforts worked as designed and protected the Waterloo-Cedar Falls metro area. However, as evidenced by the CFU structural protection system, record floods can defeat a well-designed flood protection system. This reality leads to the need for non-structural measures such as the ones designed by CFU engineers to ensure critical services during devastating natural conditions and the non-structural mitigation efforts discussed in the next section.

¹¹⁴ Personal communication between the author and Barb Hugi, 10/22/2008.

¹¹⁵ \$11.6 million estimate assumes property values in Cedar Falls are at least equal to their value in 1999 when the flood wall was credited with protecting \$5.8 million in property in downtown Cedar Falls.

¹¹⁶ Jon Erickson, "Cedar Falls Braces for Record Flood," http://www.wfcourier.com/news/top_story/article_b3cfe0ef-0f8e-5bf2-8233-55b1536493df.html (accessed 12/3/2008); and Pat Kinney, "CFU Power Plant, Offices Hit by Flood," <http://www.wfcourier.com/articles/2008/06/15/news/metro/10409858.txt> (accessed 12/3/2008).

b. Non-Structural Mitigation Efforts

Black Hawk County has aggressively pursued non-structural mitigation opportunities since the 1993 floods. The county and two largest cities, Waterloo and Cedar Falls, have used the non-structural tool of buyouts as the number one flood mitigation tool since 1993. Buyouts began as early as December 1993 with the majority of properties purchased in Cedar Falls. The initial phase purchased 12 residences using Department of Housing and Urban Development (HUD) funds through a grant program known as Community Development Block Grant. The remaining 87 properties were purchased via FEMA's Hazard Mitigation Grant Program (HMGP). Under HMGP, the federal government paid 75 percent of the cost. State and local governments were required to cover the remaining expenses. The 99 residences purchased after the 1993 floods moved 89 households to areas outside of the 100-year flood zone. Total cost of this round of buyouts was \$4.49 million. Ninety-nine percent of the cost of the buyouts was funded by a combined federal-state effort. In the first 5 years of the buyouts, the program was credited with saving an estimated \$800 thousand in damage. After the floods of 1999, the buyouts were credited with avoiding an additional \$4.4 million in damages. Original government estimates of damage avoidance stated the \$4.49 million spent to relocate the homes in Black Hawk County would save \$6.6 million over 30 years. However, by avoiding a total of \$5.2 million in the first six years, the program had already proven to be more valuable than its original cost.¹¹⁷

Realizing the value of the buyout program, Black Hawk County leveraged federal and state funds to increase the buyout program and move more families out of flood zones following the floods in 1999. FEMA's HMGP was the primary source of funding for the buyouts following the 1999 floods. The program purchased an additional

¹¹⁷ "Buyouts Dramatically Demonstrate Avoided Flood Damage: Two Cities, One Tale." http://www.wvdhsem.gov/WV_Disaster_Library/Library/FLOODS/FEMA-Buyout Mitigation.htm (accessed 8/19/2008). Source data from Black Hawk County/Cedar Falls, "Flood Buyout Expenditures: 1993 Flood & 1999 Flood"; and personal communication with Barb Hugi dated 10/22/2008.

62 properties to relocate an additional 55 households out of the flood zone. The cost of this round of buyouts was \$3.15 million, and the full amount was covered by state and federal funds.¹¹⁸

A total of \$7.64 million of federal, state, and local funds have been spent as part of Black Hawk County's buyout program since 1993. The program costs covered acquisition and demolition of 161 properties in the flood zone and relocation expenses for the 144 affected households. Prior to the second phase of the program that began after a 1999 flood, the program had already avoided an estimated \$5.2 million in damage. According to Barb Hugi in Cedar Falls and the Community and Development Director in Waterloo, Noel Anderson, all 161 of the properties acquired through the combined buyout program would have been severely damaged by the 2008 floods.¹¹⁹ Using the 2008 mean home selling price for the Waterloo-Cedar Falls area of \$120,800,¹²⁰ the buyout program in Black Hawk County avoided an estimated \$19.6 million in damage during the 2008 floods. This brings the total damage avoided to an estimated \$24.8 million, which is greater than three times the amount spent on the buyout program during the same period. The cumulative benefit to the government from the Black Hawk County buyout program is \$22.36 million. Table 5 provides an overview of costs of the buyouts compared to estimate amount of damages avoided.

Table 5. Overview of Buyout Costs and Damages Avoided 1993–2008

	Cost of Buyouts	Damages Avoided	Net Government Costs*
Post-1993 Floods	\$4,490,000		\$4,490,000
Floods (1994-1998)		\$800,000	\$3,690,000
Floods in 1999		\$4,400,000	(\$710,000)
Post-1999 Floods	\$3,150,000		\$2,440,000
Floods in 2008		\$24,800,000	(\$22,360,000)
Total	\$7,640,000	\$30,000,000	(\$22,360,000)

*Negative numbers represented by parenthesis () and amount to cumulative government benefits from cost spent on the buyout program.

¹¹⁸ Source data from Black Hawk County/Cedar Falls, "Flood Buyout Expenditures: 1993 Flood & 1999 Flood"; and personal communication with Barb Hugi dated 10/22/2008.

¹¹⁹ Personal communication with Barb Hugi on 10/22/2008; and personal communication with Noel Anderson on 11/3/2008 and 12/10/2008.

¹²⁰ "Waterloo-Cedar Falls, Iowa Community Fact Sheet," Metropolitan Statistical Area 2008 Edition.

Buyouts were not the only non-structural mitigation efforts undertaken in Black Hawk County since 1993. The local governments passed stringent ordinances consistent with FEMA's requirements for a community to participate in the National Flood Insurance Program (NFIP). These ordinances restricted new construction in the floodplain, required all new construction, and property repairs from damage greater than 50 percent to be elevated at least one foot above the 100-year flood level. Twenty-five of the properties in Waterloo that were damaged during the 1993 floods choose to elevate to meet the new requirements instead of participate in the voluntary buyout program. These 25 properties received FEMA funds through the HMGP for the elevations. The total cost of the elevations is estimated at \$250 thousand. Unfortunately, the elevations were not enough to protect the homes from the record, 500-year level floods in 2008. All 25 properties were flooded, and the city of Waterloo has placed residences in this area who volunteered to be part of the new program on a priority list of 44 homes eligible for buyouts under HMGP following the 2008 floods. All 44 residences on the new voluntary buyout list were flooded and sustained greater than 50 percent of damage.¹²¹

The damage to the 25 elevated properties in the known flood zone represents a failure of this mitigation method when compared to the success of the buyouts in the same area. The \$250 thousand spent to elevate the properties was effective; however, the results of the 2008 floods demonstrate this money would have been better spent had the residents chosen to participate in the buyout program. Based on the average cost per property (\$48,077) from the successful buyouts, \$1.2 million would have been needed to buyout these 25 properties, which would have been \$950 thousand dollars more than the \$250 thousand spent to elevate the properties. However, given the 2008 median price of homes in the Waterloo-Cedar Falls area, the additional \$950 thousand would have prevented more than \$3 million in damage. As local, state, and federal officials seek funds for further mitigation projects, it is important to realize the

¹²¹ Personal Communication with Noel Anderson on 11/3/2008 and 12/10/2008.

benefit gained from buyouts over elevations. The initial costs are more; however, in this case alone, the benefit would have been three times greater based on property values alone.

Waterloo estimates the total cost to complete the proposed post-2008 flood buyout program at \$4.6 million. Under the disaster assistance program for the 2008 floods, FEMA would provide federal funds to cover 75 percent of the costs, the state of Iowa would cover another 10 percent, and the city of Waterloo would be required to pay the difference. The City Council of Waterloo unanimously approved \$800 thousand in city funds to cover the local expenses on 26 August 2008. The approval was necessary to apply for state and federal funds to cover the remaining 90 percent of the costs of the program. City officials do not expect to know the status of their request for state and federal funds until sometime in 2009.¹²² However, serious consideration to support the requested buyout programs should be given to Black Hawk County in light of the cumulative success of previous buyout efforts, the cost to repair these repetitively flood damaged properties, and indirect costs associated with response efforts required to evacuate these areas.¹²³

Since 1993, FEMA has spent nearly \$1.14 billion on hazard mitigation projects. FEMA has hazard-mitigated over 12,000 properties with these funds over the last 15 years. Figure 13 provides an overview of FEMA hazard mitigation efforts since 1993. Note that Black Hawk County is in the upper echelon of counties that have received FEMA funds during this period. This section demonstrated Black Hawk County optimized the use of the funds to minimize flood damages during the fifteen-year period. Continued the support for these programs in Black Hawk County merits serious consideration.¹²⁴

¹²² Tim Jamison, "44 Homes on Waterlood Flood Buyout List," *Waterloo Cedar Falls Courier* August 26, 2008 http://www.wcfcourier.com/articles/2008/08/26/news/top_story/10566216.txt (accessed 12/17/2008).

¹²³ Cedar Falls has also proposed a new buyout program for approximately 100 homes damaged during the 2008 floods. However, further specifics are not available at this time. Personal communication with Barb Hugi 10/22/2008.

¹²⁴ Johnson et al., "The Great Flood of 1993 on the Upper Mississippi River—10 Years Later," USGS Fact Sheet May 2004.

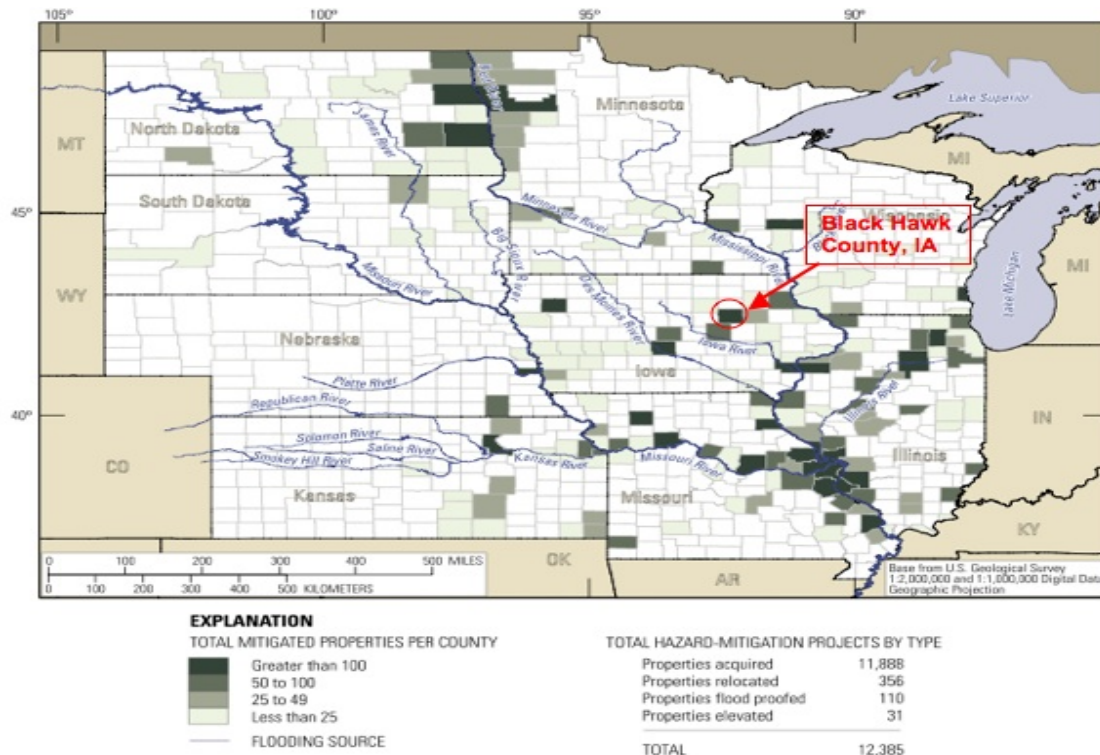


Figure 4. Hazard-mitigation projects from June 1993 through April 2003 per county for the Great Flood of 1993 region (modified from Federal Emergency Management Agency, 2003).

Figure 13. FEMA Hazard Mitigation Efforts Since 1993¹²⁵

3. Preparedness and Improved Response Capabilities

This section details specific actions taken by Black Hawk County to comply with federal guidelines associated with the National Response Framework (NRF) and National Incident Management System (NIMS) prior to the 2008 floods and captures source data for one example of the integration of local, county, state, and national agencies during response and recovery to the floods of 2008.

The major changes to disaster response since 1993 were not a result of the floods and disaster response of that year. While local responders captured and improved on the lessons from the 1993 floods, the federal level made very few changes with respect to response as a result of the 1993 natural disaster. The major changes at all levels of

¹²⁵ Modified from Johnson et al., "The Great Flood of 1993 on the Upper Mississippi River—10 Years Later," USGS Fact Sheet May 2004.

government came after September 11, 2001 (9/11). The first major changes resulted from National Security Act of 2002. This Act placed FEMA in the newly formed Department of Homeland Security and directed them to create a National Response Plan (NRP) and NIMS. The new organization, NRP, and NIMS faced their first major challenge in 2005 when Hurricane Katrina hit the U.S. Gulf Coast with devastating force. FEMA took the brunt of the critiques, and the aftermath led to further changes to the organization and guiding documents for national disaster response. The Post-Katrina Emergency Management Reform Act of 2006 directed creation of NIMS and the NRF to create a formal structure for active dialogue between the federal, state, local and tribal emergency management organizations. The changes implemented as a result of the Post-Katrina Act balanced the initial response by state and local governments and the need for proactive federal involvement when local capabilities are overwhelmed. By the time the 2008 floods hit the Midwest, changes directed by the Post-Katrina Act were in place. The 2008 Floods presented FEMA, DHS, and the affected state/local authorities the opportunity to show they had learned and applied the lessons of 9/11 and Hurricane Katrina. The floods challenged disaster response professionals at every level of government, and the nation was watching to see how they would perform.¹²⁶

In general, the media and affected residents considered the local response and support by FEMA overall favorable during the 2008 floods. Through several e-mail exchanges and a personal interview with Chief Steven Mitchell, the Cedar Falls Fire Chief and Emergency Operations Center (EOC) Commander during the 2008 floods, this section provides a local-level perspective of response preparation and major disaster response in light of the national changes that occurred between 2001 and the Floods of 2008. My interview with Chief Mitchell focused on the following:

¹²⁶ Hogue and Bea, 19–26. Sheri Fink. “Fed Officials: Response to Midwest Flooding ‘Much More Eloquent’ than to Katrina - ProPublica.” <http://www.propublica.org/article/federal-officials-response-to-midwest-flooding-much-more-eloquent-than-620/> (accessed 8/17/2008); Keith Schneider. “The Midwest Flooding; In This Emergency, Agency Wins Praise for its Response.” <http://query.nytimes.com/gst/fullpage.html?res=9F0CE6DD1531F933A15754C0A965958260> (accessed 8/18/2008); and “FEMA Earns High Marks for Response to Midwest Flooding.” <http://www.foxnews.com/story/0,2933,371085,00.html> (accessed 8/18/2008).

1. Local interactions with FEMA and USACE during the initial response and initial recovery operations.
2. His perspective of county interactions with FEMA, USACE, and the state emergency management functions (which was relevant because he also served as an assistant commander of the county EOC).
3. How long his organization had been working under the NIMS construct and his insight on how it impacted response operations during the 2008 floods.
4. Coordination processes and effectiveness between the Cedar Falls EOC, the county, and the state. Any restrictions placed on them at the local level with respect to coordinating directly with state and federal response organizations.
5. Effectiveness of National Weather Service-provided forecasts.

The Cedar Falls EOC did not have much interaction with FEMA during initial response. Chief Mitchell knew FEMA representatives were primed to support and were already in the area in support of the disastrous tornadoes that hit the area on May 25, 2008, approximately 2 weeks prior to the floods. However, he did not need or receive much support from FEMA during initial response. His primary interactions with FEMA began during recovery operations after the Cedar River crested on June 11, 2008. During recovery, FEMA's main role was to let local officials know they were available and to explain the process for individuals to receive disaster assistance associated with the presidential disaster declaration in Black Hawk County. He noted FEMA immediately set up an office to support disaster assistance requests from individuals in the general public; however, it took the agency nearly a week to assign a public assistance representative to support the city. Despite the delay in city support, from Chief Mitchell's perspective, FEMA was an asset to the disaster response and recovery when local officials and residents needed them.¹²⁷

Black Hawk County was not the only area in Iowa who had personal attention from FEMA during, or immediately following the floods. According to Brett Voorhees,

¹²⁷ Author interview with Chief Steven Mitchell on 12/3/2008.

a public relations specialist with the Iowa Emergency Management Agency, FEMA had over 1,000 personnel in the state for a couple of months following the peak of the floods to assist Iowa residence with the federal assistance process. This small snapshot provides an overall positive rating of FEMA's disaster response processes and capabilities since the Post-Katrina Act.¹²⁸

Chief Mitchell was aware of the USACE presence in his area before and during the time the Cedar River reached its record level on June 11, 2008. USACE served primarily as advisors to him as commander of the city EOC and the leaders of the county EOC. USACE spent a lot of time on the levees and would relay areas of potential weakness ("seeps and bubbles" in the levee) to the EOC so they could promptly respond to fortify the weaknesses and prevent serious breeches. Chief Mitchell considered this input beneficial and a positive contributing factor to the success of the successful effort of the team of city leaders and volunteers in their efforts to prevent the devastation of downtown Cedar Falls.¹²⁹

As far as NIMS, Chief Mitchell said Cedar Falls began compliance with NIMS training and organization requirements the same year it was initially published, 2004. Led by Chief Mitchell, the Cedar Falls emergency response team had conducted exercises with the county prior to 2008, and he said they fully used the NIMS construct in response to the tornadoes that tore through Black Hawk County on May 25, 2008. For the floods, the county was organized according to NIMS and NRF guidance with Emergency Support Functions (ESFs) identified for all the core areas. At the city level, Cedar Falls used a modified form of the ESFs and NIMS construct to organize their emergency response planning and operations functions. He was the commander of the city EOC and reported directly to the Mayor. As commander, he was responsible for all information in and out of the EOC and the operations of all emergency response

¹²⁸ Author interview with Brett Voorhees on 10/28/2008.

¹²⁹ Jon Erickson, "North Cedar Residents; City's Effort Fell Short," http://editorialmatters.lee.net/articles/2009/11/13/stories/top_stories/9unews099.txt (accessed 11/15/2009); and Jon Erickson, "Help or High Water: The Effort to Save the Cedar Falls Levee was Never a Sure Thing," *Waterloo Cedar Falls Courier* June 22, 2008 http://www.wfcourier.com/news/metro/article_c6ee4101-eb18-5f43-82af-710994e09411.html (accessed 12/12/2008).

personnel. The EOC was focused on the operations side of response. The City also had a emergency planning group working directly for the Mayor and was focused on near-term requirements, actions, and events. The planning group met at least once daily and included Chief Mitchell as the commander of the EOC. Another responsibility of Chief Mitchell as EOC commander was to serve as the primary liaison with the county EOC. All city requests for external support went through the EOC commander to the county EOC. If the request exceeded the county's capabilities, the county EOC would request support from the state EOC to satisfy the city's needs. The bureaucracy of the system added some confusion and slowed things at times according to Chief Mitchell. However, he was aware how heavily tasked the county EOC was, and he expressed gratitude that all organizations were working in the same basic construct and using the same core language and processes during the disaster response. He also mentioned that the process to get the proper state and federal declarations to acquire equipment and funds to support the response effort went very smooth and happened quickly.¹³⁰

One thing the Black Hawk County EOC did to facilitate the initial delays caused by the process was to allow numerous personnel to request items from the state EOC versus funneling all requests through a single person. Since, Chief Mitchell was an assistant EOC commander for the county, he was granted permission to make requests directly to the state EOC as long as he informed the county EOC simultaneously. Chief Mitchell specifically said the overall process created by the new NRF and draft version of NIMS as used in Iowa during the 2008 floods deserved an "overall positive critique."¹³¹

With respect to the National Weather Service (NWS) forecasts, Chief Mitchell was impressed with the timeliness of the updates and the accuracy. The initial forecast that predicted the river would exceed its previous record came four days before the river crested at its new record on June 11, 2008. This forecast enabled the city to begin assembling its EOC and complete its major response planning before major flooding threatened the city of Cedar Falls. He was surprised to hear the major jump from a prediction of 98 feet, or 2 feet above the previous record, to a forecast of 103 feet the day

¹³⁰ Author interview with Chief Steven Mitchell on 12/3/2008.

¹³¹ Ibid.

before the river crested. However, a NWS/NOAA representative was available to confirm the new forecast and validate its accuracy. This updated forecast, which placed the new flood level 2 feet higher than the design limit of the levee completed in 1999, was crucial to the city updating its evacuation orders in time to get most people out of harms way prior to the major flooding and reinforce the levee so it performed beyond its initial design capabilities.¹³²

In summary, Chief Mitchell valued the efforts of all federal organizations as they augmented the response and recovery efforts. His overall favorable rating of federal efforts led to an overall positive perspective of the interagency coordination during the 2008 floods and recovery from the disaster. Chief Mitchell also provided a positive critique of NIMS and the NRF as they guide emergency responders at all levels. Cedar Falls used the flexible, doctrinal nature of the guidance to conduct the city's emergency operations in an organization that best suited their capabilities. The adaptation by Cedar Falls enabled them to be effective while remaining compatible with the state and county EOCs and their processes. The common framework, terms, and structures provided by NIMS and the NRF had positive and negative aspects. The negative aspect was the additional bureaucracy associated with following a set structure. One positive aspect was the fact emergency responders at all levels were working from the same basic playbook. An additional positive was the fact all players had previously trained themselves and exercised together using the common playbook. The previous training and exercises proved valuable during actual disaster operations during the 2008 floods.

The interview with Chief Mitchell combined with information from the Iowa emergency management office provides a small but useful perspective of the response operations during the 2008 floods. The local perspective of interactions with the federal organizations in their post-9/11 and post-Katrina reforms is not an all-inclusive evaluation of effectiveness, but it does provide a data point considering the scope of the disaster and its impact on Black Hawk County and Cedar Falls. Further research that includes perspectives from several disaster-stricken communities is required to provide a

¹³² Author interview with Chief Steven Mitchell on 12/3/2008.

complete determination of disaster operations effectiveness. Since detailed data of the 1993 response and recovery is not available for direct comparison, this single example can serve only as an initial data point for further analysis of the effectiveness of major changes to response over the last fifteen years. Hopefully this small glimpse of a positive experience during the 2008 floods spawns research that leads to such research and a more complete evaluation to specifically address effectiveness of response in light of the more recent, post-9/11 and post-Katrina reforms.

E. CONCLUSION

This chapter was the primary analysis as to whether changes to national disaster response and investments in flood mitigation since the Great Midwest Floods of 1993 have been effective in light of the record floods of 2008. The first two sections compared the 1993 and 2008 floods from a macro level. The macro level compared the two floods at the regional and state level. This comparison found major similarities between the 1993 and 2008 floods and their impact on the Midwest. Additionally, the 2008 flood levels and initial impacts appear to be greater than the 1993 floods in Black Hawk County, Iowa. These similarities confirmed the relevance of the 2008 disaster and specific area of study to address the core questions of the thesis.

The next section of this chapter conducted a micro-level analysis on Black Hawk County and the 2008 floods. This analysis was broken into two parts, mitigation and response. The mitigation part examined the county's structural and non-structural mitigation efforts since the 1993 floods and their effectiveness during the 2008 floods. This analysis found structural and non-structural mitigation efforts in Black Hawk County since 1993 were effective and avoided damages during record floods of 2008. From a structural perspective, the \$5 million levee system completed in 1999 avoided approximately \$5.8 million of damage in downtown Cedar Falls. The non-structural mitigation effort of buyouts in Black Hawk County was also effective. At a total program cost of \$7.64 million, the buyout avoided damage to \$24.8 million of property during the 2008 disaster. The net benefit of the mitigation efforts during the 2008 floods alone was \$17.16 million. Cumulatively since the buyouts in Black Hawk County began

in December 1993, they have produced a net benefit to the government of \$22.36 million. While some mitigation efforts were not successful in preventing flood damages in 2008, the combined mitigation efforts in Black Hawk County have been successful overall. Together, the structural and non-structural mitigation efforts avoided nearly \$23 million in damages during the 2008 disaster. The property damages avoided are the easiest component to quantify, and their results alone validate the worth and effectiveness of the \$12.64 million spent on these efforts in the county since the 1993 floods. The non-quantifiable components such as decreasing the hardship on individuals and reducing the number of rescues required in the county must also be remembered when determining total value of these programs and deciding whether to fund future endeavors.

This section also included an examination of response operations in Black Hawk County in light of the changes in the federal response system in the fifteen years since the Great Midwest Floods of 1993. The examination centered on how the city of Cedar Falls conducted their emergency response operations, integrated with county and state emergency operations functions, and interacted with federal support organizations during the 2008 floods. This examination provided a small glimpse into how changes to the national emergency response capabilities and system leading to the 2008 floods affected emergency response and recovery operations as the local level. The examination found the post-9/11 and post-Katrina reforms have added some bureaucracy; however, the overall result was the reforms improved the situation and produced positive results.

In summary, this chapter compared the Great Midwest Floods of 1993 and 2008 and found the floods to be more significant in Black Hawk County, Iowa. Despite more severe flooding in 2008, the mitigation efforts implemented in Black Hawk County and improvements in the national emergency response system were effective and proved their worth during the 2008 floods. Black Hawk County's comprehensive mitigation efforts combined with implementation of NIMS and federal response guidance avoided major damages and led to an emergency response that prevented loss of life in Cedar Falls and enabled activities to reinforce the levees to protect downtown Cedar Falls, Iowa.

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VI. RECOMMENDATIONS AND CONCLUSION

A. SUMMARY OF DATA

1. Summary of Selected Cases

The 1993 and 2008 Midwest floods were similar in their scope and impact to the region. The Midwest experienced two 500-year floods in a fifteen-year period, and both floods directly impacted the area for 3 months. With nine states impacted in 1993 and five in 2008, the overall scope of the storms was not as great. However, the magnitude of the 2008 floods to the areas that were impacted was equal to or greater than the 1993 floods. In Iowa, the 2008 floods caused similar levels of property damage and delivered more than \$1 billion more of damage to crops than in 1993. The detailed analysis focused on the Cedar Falls-Waterloo metropolitan area of Iowa because the Cedar River exceeded the 500-year flood level in this area for both cases. This area was also selected because it had invested millions of local, state, and federal funds to multiple types of flood mitigation during the fifteen-year period between the floods. The similarities of the two storms in size, duration, and impact to the selected area of study within Iowa enabled a comparative analysis of flood mitigation for this study and provided insight into the current state of major disaster response.

2. Summary of Findings

The analysis within Iowa helped address whether investments in flood mitigation and changes to national disaster response have been effective and provided findings to help form recommendations for future efforts. The limited data on disaster response prevented a direct comparison of response during the two disasters; however, the sample from 2008 does provide insight on how the post-9/11 and post-Katrina changes are being implemented at a local level and some positive results to build upon in future studies. The detailed analysis of the Cedar Falls-Waterloo area demonstrated clear examples of

both effective and ineffective flood mitigation efforts. Specific findings from the disaster response sample and flood mitigation analysis are detailed in the following sections to provide the baseline for recommendations.

a. Summary of 2008 Disaster Response

The details provided by Chief Mitchell provided an overall favorable rating of federal efforts and demonstrated a positive perspective of the interagency coordination during the 2008 floods and recovery from the disaster. His account specifically highlighted examples of how locally deployed federal agencies benefited initial response and recovery to the record floods. Interactions with the U.S. Army Corps of Engineers (USACE) enabled rapid response to fortify weaknesses in the levee as they occurred. Accurate forecasts from the National Weather Service (NWS) and the benefit of confirming the rapidly changing forecasts with local NWS representatives proved crucial to updating evacuation orders to get most people out of harms way prior to the floods and to strengthen the levee in the downtown area to hold back the record floods. The availability of local FEMA representatives was also a valuable resource from the very beginning of and throughout the recovery efforts. Despite the infancy of the National Response Framework (NRF) and the National Incident Management System (NIMS), the positive interagency experience and effective implementation of NRF and NIMS within Black Hawk County, Iowa provides a positive example and support for continued utilization to guide emergency responders at all levels.

The flexible, doctrinal nature of the national guidance allowed Cedar Falls to adapt to best suit their emergency operations needs and capabilities while remaining integrated with the county, state, and federal organizations. The common framework, terms, and structures provided by NIMS and the NRF had positive and negative aspects. The negative aspect was the additional bureaucracy associated with following a set structure. However, the negative impact was minor in comparison to the positive benefits. Specifically, the fact that emergency responders at all levels were working from the same basic playbook was a big positive. Additionally, in this example all players had previously trained themselves and exercised together using the common playbook. This

small but useful perspective of the response operations during the 2008 floods provides a useful data point for future evaluations of national disaster response in the post-9/11 and post-Katrina environment.

b. Ineffective Flood Mitigation

The analysis uncovered two examples of ineffective flood mitigation. The first was a privately funded structural effort designed to protect the facilities of Cedar Falls Utilities (CFU). The concrete walls and water-filled bladders failed to prevent waters from the record crest of the nearby Cedar River from flooding the facility. The facilities were located within the 500-year flood zone; however, the protection was not certified to protect to that level. If funds are going to be spent on structural protections, the protection system must be built to a level of protection greater than the flood zone rating. Otherwise, serious consideration must be given to non-structural mitigation such as relocation out of the flood zone and contingency operating plans.

The second ineffective flood mitigation practice discovered during analysis involved federal funding under FEMA's Hazard Mitigation Grant Program (HMGP). Since the 1993 floods, twenty-five properties were elevated to one foot above the 100-year flood level using an estimated \$250 thousand of HMGP funds. The elevations were not enough to prevent any of the 25 properties from flooding during 2008's 500-year flood. If these residents had chosen to relocate after the 1993 floods, it would have cost approximately \$950 thousand more and prevented more than \$3 million of flood damage during the 2008 floods. The greater initial cost is warranted considering the greater gain in the long term and the realization that the \$250 thousand spent on elevations was not effective in the long term.

c. Effective Flood Mitigation

The analysis of flood mitigation efforts in Black Hawk County, Iowa provided examples of effective structural and non-structural mitigation efforts since the 1993 floods. Following the 1993 floods, Black Hawk County received a \$5 million flood protection project to protect the downtown business area of Cedar Falls. A combination

of funds from local, state, and federal governments funded the project. The effort installed a levee-based protection system designed and built by USACE to protect against a 250-year flood. Completed in 1999, the project can now be credited with protecting Cedar Falls from an estimated \$11.6 million in property damage. By preventing property damages more than double the cost of the project, this example demonstrates that properly designed, built, and maintained protection systems can produce benefits greater than initial costs.

Analysis of Black Hawk County also provided a clear example of effective non-structural mitigation efforts. Under FEMA's HMGP, the county actively participated in buyouts as the core component of their non-structural mitigation efforts. Unlike ineffective use of elevations under FEMA's HMGP, buyouts have been an effective mitigation effort in the county since 1993. Since 1993, the county has used HMGP funds in combination with state and local funds to purchase 161 properties and relocate 144 households from high-risk flood zones. The total cost of the buyouts since 1993 is \$7.64 million, and the effort is credited with avoiding approximately \$30 million in damage (including damages avoided in 2008). This means the cumulative net benefit of the buyout program is \$22.36 million, and demonstrates how this non-structural effort can be an effective use of government funds as part of an overall flood mitigation effort.

The positive results in Black Hawk County support a comprehensive approach of structural and non-structural mitigation approaches to flood mitigation. Collectively, the efforts in Black Hawk County are credited with preventing approximately \$41.6 million in property damage. Compared to a total cost of \$12.64 million, the cumulative positive effect of the combined efforts is a net worth of \$28.96 million.

3. Challenges

The similar floods that occurred in 1993 and 2008 provided an analysis that highlighted effectiveness and ineffectiveness of flood mitigation efforts during the fifteen year period between the floods and provided a sample of major disaster response in light

of recent reforms at the national level. Before using the findings to provide recommendations, it is important to note a couple of key challenges to improving overall flood mitigation efforts in the future.

The first challenge is one that has existed as long as mitigation has been considered a national interest. When floods are at the forefront of national attention, the increased interest leads to more active efforts to improve and more resources allocated to affect the improvements. It is difficult to keep flood mitigation a top priority with so many competing interests in the U.S. Flood mitigation, response, and recovery receive national attention when they reach the level of disaster of the 1993 and 2008 floods. For example, in 1993, the Midwest floods were ranked the top story of the year, and the vast national exposure is one of the reasons the nation underwent a philosophical shift in the way it addressed floodplain management and mitigation. The new philosophy led to many changes and the types of improvements noted in effective mitigation noted in the findings section. On the other hand, according to a Pews research study the 2008 floods barely ranked as one of the top 15 stories of 2008 despite its severity and impact to the same region of the country. The challenge is to always keep flood mitigation a national priority among many competing interests in the U.S. At a minimum, flood-prone communities must always have a plan so they are prepared to capitalize in post-flood periods when national interest is high.¹³³

The second challenge is an emerging one due to increased national importance of agriculture. For obvious reasons, farmland has not been protected or to the same level or considered as important as populated areas. In some cases farmland is set aside to increase water absorbency of lands near rivers and to serve as runoff areas for inevitable flooding near major rivers. This practice has made sense in the past; however, it will pose new challenges as the demand for alternative energy sources, such as ethanol, leads agriculture to a greater level of national importance than solely a food supply.

¹³³ Changnon, 300; “Top News Interest Stories of 2008,” <http://pewresearch.org/pubs/1066/internet-overtakes-newspapers-as-news-source> (accessed 9/7/2009); and “Gas Prices Dominate the Public’s Economic News Agenda – Fewer Following Midwest Floods Than in 1993,” <http://pewresearch.org/pubs/874/gas-prices-dominate-the-publics-economic-news-agenda> (accessed 9/7/2009).

The boom in the ethanol industry over the last several years has caused the production of ethanol to grow from 1.2 billion gallons in 1993 to 9 billion gallons in 2008. In 2007, 98 percent of ethanol was produced from corn. The increased demand has increased total corn consumption by more than 5 billion bushels per year in the fifteen-year period since the 1993 floods and driven corn prices to double in the same period. Figure 14 provides a snapshot of how demand for corn use to produce ethanol has increased over the last twenty-eight years.¹³⁴

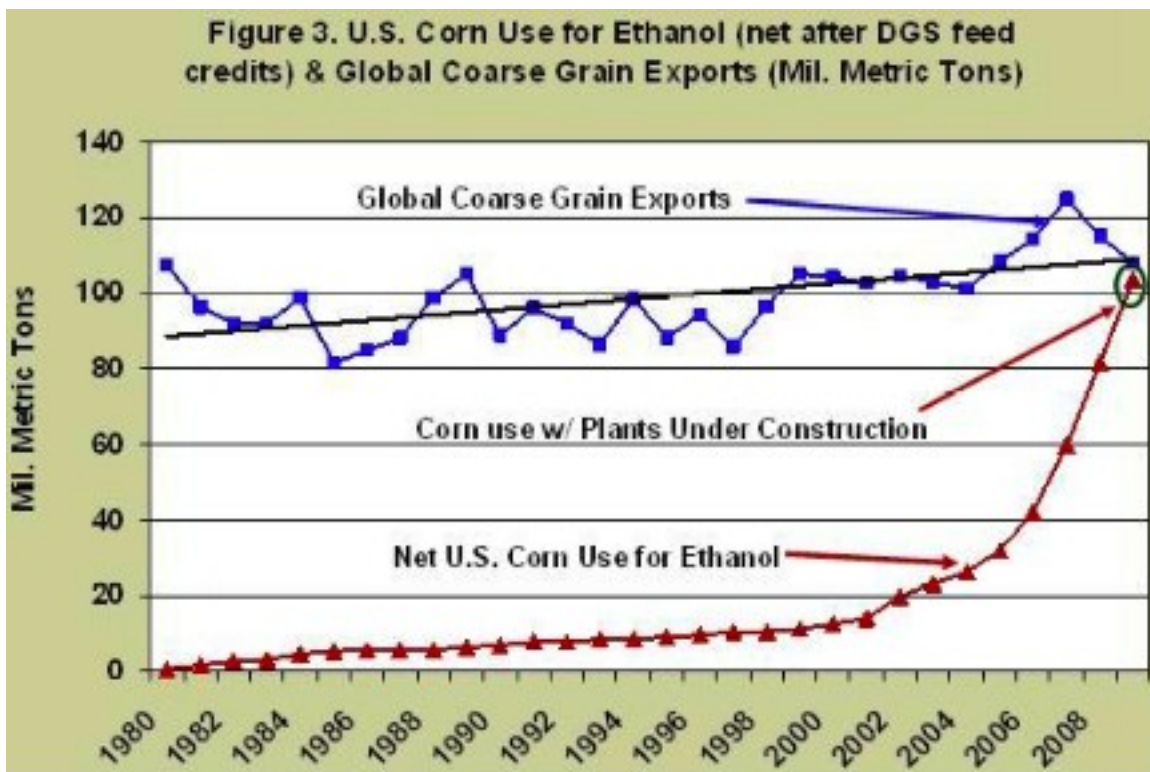


Figure 14. Corn Use for Ethanol Since 1980¹³⁵

¹³⁴ Eric Kelderman, "Ethanol Demand Outgrows Corn," <http://www.stateline.org/live/details/story?contentId=219881> (accessed 9/24/2009); Renewable Fuels Association, "Statistics: Historic U.S. Fuel Ethanol Production," <http://www.ethanolrfa.org/industry/statistics/#A> (accessed 9/24/2009); and "U.S. Corn Variables (1975/76–2007/08)," <http://www.farmdoc.uiuc.edu> (accessed 9/24/2009).

¹³⁵ "Agricultural Marketing Resource Center," http://www.agmrc.org/media/cms/image_5_92C4DFC1A28F6.jpg (accessed 9/24/2009).

Affects of the greater demand and profitable of corn could be seen on one farmland-based flood mitigation effort in Iowa prior to the 2008 floods. The Conservation Reserve Program (CRP) is a national program that pays farmers to keep farmland uncultivated to increase the ability of land to absorb water. In the period between 2007 and 2008, farmers removed 106,000 acres of land from the CRP to increase their corn production. Evidence does not suggest cultivating the additional acres caused the historic flooding of 2008.¹³⁶ However, this highlights the emergent challenge in the area of flood mitigation that old policies related to the use of farmland for flood mitigation are going to be challenged as agricultural products serve more than their basic purpose and become an even greater area of national interest.¹³⁷ Specifically, producing alternative energy sources from agricultural products will drive innovative changes to the traditional dynamics of flood management and control throughout the U.S. Addressing the required changes will present unique challenges in the area of flood mitigation for years to come.¹³⁸

4. Areas for Further Study

This thesis provides detailed analysis of flood mitigation efforts in Iowa during the fifteen-year period between the Great Floods of 1993 and 2008. The findings in this specific area are useful. However, the findings also highlight at least two prime opportunities for further study with respect to flood mitigation and disaster response. For starters, the lack of specific data from the 1993 disaster prevents a direct comparison of the efforts from the two events. While the study provide some insight to a single major

¹³⁶ Joel Achenback, "Iowa Flooding could be an Act of Man, Experts Say." *The Washington Post*, June 19, 2008, <http://proquest.umi.com/pqdweb?did=1497097381&Fmt=7&clientId=65345&RQT=309&VName=PQD> (accessed 8/13/2008).

¹³⁷ This also highlights the difficulty in getting firm data on the impact of floods and flood mitigation policies because the variables, in this case land use policies, change from year to year.

¹³⁸ Overall corn production decreased by nearly 10 million acres in 1993 and 8 million acres in 2008. The decrease in supply did not cause a price spike in 1993; however, it did caused a price increase of more than \$1 per bushel in 2008 (\$4.20/bushel in 2008 versus \$3.04/bushel in 2007). "Corn and Soybeans: Harvested and Acreage and Yield Per Acre," <http://www2.econ.iastate.edu/outreach/agriculture/periodicals/chartbook/Chartbook2/Tables/Table10.pdf> (accessed 9/24/2009) ; and "U.S. Corn Variables (1975/76–2007/2008)," <http://www.farmdoc.uiuc.edu> (accessed 9/24/2009).

response effort since the changes to the national system as a result of 9/11 and Hurricane Katrina, the lack of data prevented a conclusive judgment as to whether changes made to the national response system are better than they were in 1993. Therefore, future studies could compare data captured by this study with detailed data of future disaster response efforts to provide a quality analysis of whether the changes to the national system have improved at the local, state, and national level. Hopefully this small glimpse of a positive disaster response experience during the 2008 floods spawns research that leads to a more complete evaluation of national response effectiveness in light of the post-9/11 and post-Katrina reforms.

The second area for further research could build on the results found in the analysis of Black Hawk County's flood mitigation efforts in the period between the 1993 and 2008 floods by doing a similar analysis of another area stricken by the two floods and comparing the results to this study. Similar results could add greater support to the effective measures identified in Black Hawk County and help justify changes to policies that support the measures that were not effective. Dissimilar results could lead to further analysis as to why the efforts were successful in one area and not another.

B. RECOMMENDATIONS

The results of this study have led to the following recommendations. The recommendations cover the areas of flood mitigation, disaster response, and specifically address the challenges identified in the previous section. The overall recommendation is in line with recommendations made by Hoyt and Langbein as far back as 1955 and again by the Galloway Commission in 1994. The overall recommendation is that a comprehensive approach to land use surrounding water resources combined with multi-faceted flood mitigation efforts and an adaptive response force is necessary to make the most use of the vast natural resources near major waterways. A multi-faceted approach to flood mitigation must include both structural and non-structural efforts, and the

adaptive response force must include trained response and recovery forces in high risk areas and contingency plans to ensure basic services in the inevitable event that the natural phenomenon of floods occur.¹³⁹

More detailed recommendations can be offered based on the findings of the study. With respect to structural mitigation efforts, the study demonstrated how well designed, built, and maintained flood protection systems can be effective. The flood protection system in Cedar Falls has already prevented damages equal to twice the amount of the cost of the system completed in 1999. The difficulty is effective protection systems such as this are expensive initial investments and hard to justify when water levels are at safe levels. However, according to the American Society of Civil Engineers every \$1 spent on flood protection has returned nearly \$6 in flood protection and prevented an average of \$22 billion of damage each year.¹⁴⁰ Armed with this data and the results of this study, I recommend renewed national investments in flood protection systems. The investments must consider the growing national importance of crops used for alternative energy sources, upgrades to existing protection systems, and local state and federal leaders need to get improved flood protection systems at the top of the list of major projects. In addition to providing enhanced flood protection, the projects would create local jobs in a time when the national unemployment rate is nearing double digits.¹⁴¹

Based on successful and unsuccessful non-structural efforts in Black Hawk County, continued support for buyouts under FEMA's HMGP is recommended. Not only do buyouts prevent the amount of direct damage to property, they also decrease the number of people who must be accounted for and evacuated during a major flood. This indirect benefit decreases the strain on the disaster response force, which can increase the response force's effectiveness in other areas.

¹³⁹ Galloway, v-xiii; Hoyt and Langbein, 11.

¹⁴⁰ "Report Card for America's Infrastructure: Navigable Waterways," <http://www.asce.org/reportcard/index.cfm?reaction=factsheet&page=11> (accessed 10/18/2009).

¹⁴¹ National unemployment rate was 9.5% according to the U.S. Department of Labor. "Bureau of Labor and Statistics: Economic News Release, Employment Situation Summary," <http://www.bls.gov/news.release/empst.nr0.htm> (accessed 10/18/2009).

On the other hand, continued support for elevations as currently implemented under HMGP is not recommended. The positive aspects of elevations are they are less expensive than buyouts, they do not require families to move, and they provide protection from at least a 100-year flood. However, the properties are not protected when floods exceed the 100-year level. Based on the reality that floods can exceed the 100-year level in any given year, the practice of elevations has two negative impacts to overall flood mitigation efforts. First, it adds strain on the response force to ensure the safety of the families in elevated homes. Second, my analysis showed it does not provide a positive benefit in the long term. If elevations are going to remain a component of any flood mitigation effort, I recommend a change to HMGP to decrease the amount of federal funding available to this effort. I recommend a federal maximum of 50 percent to cover the cost of elevations with states and local governments only allowed to pay 25 percent of the cost. This would require local residents to fund at least 25 percent of the cost of elevations. The purpose behind this change is to decrease government investment in projects without the greatest long-term benefit and increase personal accountability and responsibility for the decision to remain in a flood zone without protection from floods greater than the 100-year level. This minor change would also encourage more use of the effective buyout method under HMGP and increase the availability of funds for the buyouts.

The funding structure of HMGP allows the federal government to provide up to 75 percent of the cost of individual projects. State and local governments are required to fund the remaining 25 percent. The cost-share nature of HMGP increases local accountability and responsibility for the individual projects. Therefore, regardless of the specific projects funded, I recommend the maintaining and enforcing the cost-share component of HMGP to ensure continued success of the program.¹⁴²

Despite the limited study in the area of response, the experience in Black Hawk County provided some positives that lead to a couple of recommendations. Chief Mitchell noted the effectiveness in the lines of communication between city, county,

¹⁴² “FEMA: How much money is available in the HMGP?”
<http://www.fema.gov/government/grant/hmgrp/FAQHowmuchmoney.shtm> (accessed 12/1/2008).

state, and national organizations during the 2008 response and recovery efforts. One reason he thought the lines of communication were effective is because they had been established prior to the 2008 floods. All organizations knew their primary points of contact and were familiar with how the integrated efforts were designed to work. This leads to the first recommendation in response. In addition to organizing and training based on NRF and NIMS guidelines, I recommend response organizations at all levels maintain non-crisis lines of communication that can be expanded during times of crisis. The second recommendation is that areas subject to specific types of disasters, such as floods, must ensure they have a trained and ready force at all times. The training must cover everyone from the first responders to government officials who will be charged with coordinating major response efforts. This includes specific training for first responders on the most likely type of disaster, the basic training on NRF and NIMS for all personnel, and periodically exercising aforementioned lines of communication between different levels of government and the diverse set of government agencies.

I also have recommendations to address the challenges to future flood mitigation efforts. Public interest in flood mitigation is not very high until major floods begin to cause mass devastation, which is too late to prevent damage and suffering caused by massive floods. Therefore, all levels of government must commit to an integrated approach to flood mitigation. The commitment is especially important for communities located in high-risk areas. These communities must utilize resources gained from the benefit of living near major water sources to prevent the impact of floods when they occur. I recommend specific federal regulations that reward communities, such as Black Hawk County, for their commitment to flood mitigation by providing more resources to augment their successful efforts. Federal regulations should also have specific restrictions on spending funds in communities without a record of proven success and who fail to commit adequate local resources to continuous improvements in flood mitigation. The commitment must persist well beyond the immediate recovery after a major event, as was the case in Black Hawk County during the entire fifteen-year period since the 1993 floods. This approach provides incentives for continued improvement regardless of the current flood situation, eliminates spending in areas who are not willing to help themselves, and provides a passive enforcement mechanism for compliance with federal guidelines and recommendations.

The emerging challenge in flood mitigation with respect to the use of farmland for flood mitigation are going to be challenged as agricultural products serve more than their basic purpose and become an even greater area of national interest. The growing trend of producing alternative energy sources from agricultural products requires crops to be accounted for in new ways. Innovative changes to the traditional dynamics of flood management and control throughout the U.S. must occur. Therefore, I initially recommend changes to federal regulations that specifically require all future flood mitigation projects to include analysis on the impact to crops that serve the dual purpose as a food supply and source for alternative energy. This will help account for crops in new ways and can lead to better justification for federal investment as alternative fuels become a more significant national interest.

C. CONCLUSION

My hypothesis was the \$54 million spent by FEMA, state, and local governments on mitigation efforts in Iowa since the 1993 floods combined with tighter integration of the federal response system with state and local response organizations have improved the overall situation.¹⁴³ My analysis confirmed my hypothesis with respect to flood mitigation during the fifteen-year period between the 1993 and 2008 floods in the Midwest. I found details from both the successful endeavors and the shortcomings in flood mitigation that led to recommendations for enhancing and focusing federal efforts to minimize the impact of future floods.

Unfortunately, the lack of specific data from response efforts during the 1993 floods prevented a direct comparison of the two events in this area. However, I did find that overall disaster response efforts during the 2008 floods were favorable. The small sample I studied provided some recommendations for the future of disaster response.

¹⁴³ “Buyouts Dramatically Demonstrate Avoided Flood Damage: Two Cities, One Tale,” http://www.wvdhsem.gov/WV_Disaster_Library/Library/FLOODS/FEMA-Buyout Mitigation.htm (accessed 8/19/2008).

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